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TEACHER INFLUENCE, PUPIL ATTITUDES, AND ACHIEVEMENT.

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THE SPONTANEOUS BEHAVIOR OF A TEACHER AND HOW THIS BEHAVIOR AFFECTS LEARNING IN THE CLASSROOM WERE INVESTIGATED. INDEPENDENT VARIABLES IN THE STUDY WERE DIRECT TEACHER INFLUENCE, AND THE NATURE OF THE SPECIFIC LEARNING TASK. THE DEPENDENT VARIABLES WERE THE ACTUAL MEASURES OF LEARNING, INCLUDING AWARENESS OF FACTS, APPLICATION OF PRINCIPLES TO PROBLEM SOLVING, AND INTERPRETATION OF NEW DATA. PRETESTS, POST-TESTS, AND DELAYED-RECALL TESTS WERE ADMINISTERED, AND RESULTS WERE ANALYZED SEPARATELY FOR GIFTED, AVERAGE, AND SLOW STUDENTS, AND FOR STUDENTS SCORING HIGH OR LOW ON A PERSONALITY SCALE OF DEPENDENCE-INDEPENDENCE PRONENESS. SAMPLES WERE DRAWN FROM SEVENTH- AND EIGHTH-GRADE CLASSES. THE FIRST YEAR OF THE STUDY CONSISTED OF LABORATORY EXPERIMENTS, WITH 560 STUDENTS IN GEOMETRY AND 480 IN SOCIAL STUDIES, AND TESTING TEACHER INFLUENCE AND STUDENT DEPENDENCE-INDEPENDENCE. FIELD STUDIES WERE CONDUCTED DURING THE SECOND YEAR, TESTING THE EFFECTS OF TEACHER INFLUENCE IN 37 SOCIAL STUDIES AND 38 MATHEMATICS CLASSROOM SITUATIONS. TWO HYPOTHESES GENERALLY SUBSTANTIATED IN THE PROJECT RESULTS WERE THAT DIRECT TEACHER INFLUENCE INCREASES LEARNING WHEN STUDENT PERCEPTION OF A SPECIFIC GOAL IS CLEAR AND ACCEPTABLE, AND THAT INDIRECT TEACHER INFLUENCE INCREASES LEARNING WHEN STUDENT PERCEPTION OF A SPECIFIC GOAL IS CONFUSED AND AMBIGUOUS. RESEARCH IMPLICATIONS WERE PROVIDED FOR CLASSROOM TEACHERS, PRESERVICE AND INSERVICE EDUCATIONAL METHODS, MERIT PAY PROGRAMS FOR EDUCATORS, AND FURTHER STUDENT-TEACHER INTERACTION ANALYSIS. (JH)

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TEACHER INFLUENCE

PUPIL ATTITUDES AND ACHIEVEMENT

STUDIES IN
INTERACTION ANALYSIS

by
NED A. FLANDERS

University of Minnesota
1958 - 1960

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TEACHER INFLUENCE, PUPIL ATTITUDES, AND ACHIEVEMENT

by

Ned A. Flanders

UNIVERSITY OF MINNESOTA
Minneapolis, Minnesota

November 30, 1960

Final Report
Cooperative Research Project No. 397

The research reported herein was performed pursuant to a contract with the United States Office of Education, Department of Health, Education, and Welfare.

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A project of this size is truly a team effort. All members of the staff rightfully share the satisfaction that comes when the job is finished. Each contributed in his own way, but willingness to work beyond original estimates and commitments has turned out to be a common characteristic.

The entire staff is especially indebted to the many individuals in the public schools of the Twin Cities area who provided us with access to data. We would like to thank the superintendents of the Minneapolis and St. Paul Public Schools for approving our initial plans. We found that the Twin City Research Advisory Committee, which included parents and schoolmen appointed by the superintendents, was willing and able to provide us with wise counsel. Many teachers went out of their way to help us succeed primarily because they considered it a professional priviledge. We found that our many contacts with the student population were always eventful and refreshing. Our inability to thank them personally for their help will go unnoticed in their busy world.

We appreciated the opportunity to consult with the research teams of Prof. Ronald Lippitt, University of Michigan, and Prof. Herbert A. Thelen, University of Chicago, at our short conference at Ann Arbor.

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Should anyone find this report useful, he can credit the entire team. Any shortcomings of the design, writing or interpretation are the responsibility of the project director.

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Chapter One

THE PURPOSE AND ORGANIZATION OF THE RESEARCH

Purpose

This is a report on how the spontaneous behavior of a teacher affects learning in the classroom. The study is based on several theoretical principles about teacher influence patterns and the effects of these patterns on the achievement and the attitudes of students. It is not primarily concerned with the teacher, his behavior and his effectiveness, although the results will have implications for this topic. Neither is it primarily concerned with the student, his behavior and his achievement, even though the results will include information of this sort. The study is concerned primarily with the spontaneous interaction between teacher and student, the interplay between different acts of the teacher and the reactions of different types of students.

This two year project gains perspective as part of a larger research program. In 1954-55 work was initiated at Minnesota to improve existing systems for analyzing the spontaneous acts of the classroom teacher, to identify patterns of acts that seemed most influential, and to study relationships between these patterns and the attitudes of students. This work was continued in 1955-56. In the calendar year of 1957 the early studies were repeated in New Zealand with the aid of a Fulbright Research Scholarship. These earlier studies provided results that showed a clear relationship between the verbal statements of the teacher and corresponding attitudes among students.

The present project, 1958-60, provided the resources necessary to include measures of student achievement, where before only attitudes were measured. It seemed reasonable to suppose that once certain acts of the teacher were found to be related to particular student attitudes, then any differences found in student achievement could be explained in greater detail. Too often experiments in which there are significant differences in student achievement provide an inadequate explanation of how these differences came about. To those of us most closely related to the research program, the initial priority given to the assessment of student attitudes seemed both logical and necessary.

The research program over the past six years has made progress in a series of steps. First, it was necessary to develop research tools. Second, tentative relationships between teacher behavior and student reactions were identified. Third, these relationships were tested in Minnesota and New Zealand. Fourth, the present project is concerned with relationships between classroom interaction and student achievement. And fifth, those ideas that have merit will be incorporated into instructional materials, both written and audio-visual, and used in a special inservice training project designed to determine if knowledge of these ideas will help teachers improve their instruction.

The inservice project will occur during 1960-61 and will answer a number of questions. Can teachers be made aware of their present patterns of influence? Can these patterns be modified to improve instruction? Can teachers be taught to control their behavior by consciously following certain principles of teacher influence? Will our present research tehcniques identify changes in teacher behavior when, and if, they do occur? The inservice training project will apply the theory in practical situations.

The Supervisory Research Committee

Research of this type requires sympathetic and cordial access to classrooms in the community. A research advisory committee was created to help establish and maintain good relationships with Minneapolis and St. Paul Public Schools. The committee members were appointed by the two superintendents and consisted of two parents, two teachers, two principals and two representatives of the central administration from each of the Twin Cities.

Every paper-and-pencil instrument, experimental procedure, and time schedule was reviewed by this committee and, if necessary, altered to obtain its approval. The parents were asked, "Would you approve of the participation of your children in this project?" The teachers were asked, "Would you approve of having this procedure carried out in your classroom? The principals were asked, "Would you permit these research activities in your school?" And the central administration representatives were asked, "Are these research plans consistent with your present programs and designed to interfere as little as possible with the major functions of the schools?"

The work of this committee contributed essential help to the total

Title: The Effects of Direct and Indirect Teacher Influence on Learning (USOE/397)

Investigator: Ned A. Flanders

Institution: University of Minnesota, Minneapolis, Minnesota

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PROBLEM

In this study, the influence of the degree of directedness on the part of the teacher on the teaching-learning situation will be investigated.

MAJOR OBJECTIVES

1. To investigate the effect of direct and indirect teacher influence on the learning of gifted, average and slow students, and students who could be classed as dependent compared with those who are more independent;

2. To investigate the relation of the learning task ("ambiguous" or "clear") to the type of influence required to be exercised by the teacher; and

3. To identify the periods, if any, in the overall cycle of classroom learning at which direct or indirect teacher influence is most effective.

PROCEDURES AND DESIGN

The independent variables in the study will be direct teacher influence, indirect teacher influence, and the nature of the learning task. The dependent variables will be measures of learning, including awareness of facts, application of principles to problem solving, and interpretation of new data. Pretests, posttests, and delayed-recall tests of achievement will be administered, and the data will be analyzed separately for gifted, average, and slow students and for students scoring high or low on a personality scale of dependence-independence proneness. The student sample will be drawn from seventh-and eighth-grade students. The first year of the project will consist of laboratory experiments testing specific hypotheses about teacher influence and student dependence-independence. Field studies will be conducted during the second year, testing the effects of teacher influence in public school classroom situations.

project. Its mere existence created a resource ready to support the research program in case controversy arose. None occurred. Several suggestions about scheduling, item modification, methods of soliciting cooperation, and procedures used in the classroom were made, discussed and adopted. The relationships between research team and the committee were always most constructive. We are indebted to this committee for its fine help and cooperation.

The Contract Requirements

One difference between a research grant and a research contract is that the researcher under a contract agrees to meet the specifications of the research proposal. For those readers of this report who might wonder if the project met the requirements of the proposal satisfactorily, the following brief overview is written.

During the first year of this two year project it was agreed that 528 students would participate in four experimental treatments, once in a social studies content area and once in a science content area. As it turned out, a learning task in geometry was substituted for the science learning task and 560 students participated in the four required treatments. In addition, 480 different students participated in the same four treatments in which the learning task was in the content area of social studies. The total number of students participating in the laboratory experiments was 1,040. Each experimental group consisted of 20 students; five in the top quartile of I.Q., five from the bottom quartile, and ten from the middle two quartiles.

Also during the first year, over 1,000 additional students in 34 classrooms participated in the standardization of a test designed to measure a personality trait called "dependence proneness."

During the second year, it was specified in the proposal that a test to select teachers who would later teach two week units of study would be administered to approximately 75 classes in the field of science and the field of social studies. Sixty-five classes took the test because only those teachers who would be willing to go on and teach the two week unit of study were permitted to volunteer. Over 2,000 students took the test that provided us with the information necessary to select the teachers who would teach the two week units of study.

Eighth grade, single hour, mathematics classes and seventh grade, two hour combined English and social studies classes were used for this phase of the study. The combined English/social studies classes were used because there would be more opportunity for a wider variety of class activities than normally occurs in a one hour class.

Hereafter, the English/social studies classes will be referred to merely as social studies classes for the sake of brevity.

Based on the test results, we were to select the teachers of the highest and lowest scoring classes; the contract called for a total of twenty teachers to teach the social studies and mathematics (science) units of study. Instead it seemed wise to select the top eight and bottom eight in each content area so a total of 32 teachers and over 900 students participated in this phase of the project. Sixteen eighth grade mathematics classes studied an advanced geometry unit for two weeks. Sixteen seventh grade social studies classes studied a specially prepared unit on New Zealand for two weeks. The mathematics classes met for one 55 minute period each day; the social studies classes met for a double period each day.

In addition to this, pilot runs for the first year were carried out in suburban schools of the Twin Cities area.

Altogether, over 4,000 students and 100 teachers had some kind of contact with this project. The project research staff is deeply indebted to the teachers, students and administrators of the Minneapolis and St. Paul public schools for their cooperation and participation.

This contract also made it possible for two members of the research team to carry out adjunctive studies that proved acceptable for their Ph.D. thesis requirements. Two other graduate students were successful in obtaining their M.A. degrees by investigating problems related to this project.

Chapter Two

THE RATIONALE OF THE STUDY

It is sometimes difficult for a researcher to know the most important contribution of a research study. In this project a statement of the rationale could emphasize either one of two major outcomes. One outcome could be in research methodology, the other could be the testing of some hypotheses that show promise of contributing to a theory of instruction.

The emphasis on research methods would stress the refinement of classroom interaction analysis and its validation as a tool for assessing teacher influence. The field of educational research has had no systematic procedures for quantifying the qualitative aspects of spontaneous teacher influence. The progress made in this project toward this goal justifies choosing this theme as the rationale of the study.

On the other hand, theoretical speculations about teacher influence are equally important. For too long, educational thinking about the power of the teacher and how he influences the class has been hung on the democratic-authoritarian dichotomy which stresses good versus bad as an all black, all white forced choice. If only one outcome of the Minnesota research program could be mentioned, one might choose the generalization that we have never seen a teacher consistently provide a pure type of influence in the classroom. The eagerness of practitioners, researchers, and the general public to seek simple solutions to complex problems is understandable, but our findings do not support such naivete.

The balance of this chapter is divided into three parts: first, a review of previous research on classroom climate; second, an introduction to some of the concepts and theories peculiar to the present project; and third, a statement of the major hypotheses of the project. In every section reference is made to practical classroom situations. In some instances, the reader is referred to the various appendices of this report for more detailed information.

Research on Classroom Climate

Earlier studies:--In our society the authority to direct the learning activities of the student is given to the teacher. Both the teacher and the students expect the teacher to take charge, to initiate learning activities, and to contribute information as needed in the problem solving process. What the teacher does with his power makes a great deal of difference.

None of the research about to be reviewed concludes that any one pattern of teacher behavior is superior to another. In several studies contrasting patterns are identified, named, and the different outcomes for the various patterns reported. The overt behavior of teachers or group leaders in these early experiments was a complex pattern and not a pure type, although this was not always made clear to the reader. The different outcomes noted were caused by differences in the balance of the contrasting patterns.

The words classroom climate refer to generalized attitudes toward the teacher and the class that the pupils share in common in spite of individual differences. The development of these attitudes is an outgrowth of classroom social interaction. As a result of participating in classroom activities, pupils soon develop shared expectations about how the teacher will act, what kind of person he is, and how they like their class. These expectations color all aspects of classroom behavior creating a social atmosphere or climate that appears to be fairly stable, once established. Thus, the word climate[1] is merely a shorthand reference to those qualities that consistently predominate in most teacher-pupil contacts and contacts between pupils in the presence or absence of the teacher.

---

[1] Climate is assessed either by analyzing teacher-pupil interaction and inferring underlying attitudes from the interaction, or by the use of a pupil attitude inventory and predicting the quality of classroom interaction from the results. Its precise meaning as commonly used, is seldom clear--just as its synonyms "morale," "rapport," and "emotional tone" are also ambiguous. To have any meaning at all, the word is always qualified by an adjective and it is in the choice of adjectives that researchers become reformers and lose their objectivity; e.g., Lippitt and White's choice of "authoritarian" and "democratic" to describe climate.

The earliest systematic studies of spontaneous pupil and teacher behavior that relate directly to classroom climate are those of H. H. Anderson and his colleagues Helen and Joseph Brewer and Mary Frances Reed (1, 2, 3, 4) and are based on the observation of "dominative" and "integrative" contacts. It is essential to understand the qualitative differences between an integrative and a dominative social contact because most of the research on classroom climate makes similar behavioral distinctions.

> "A preliminary study showed that it was possible to devise reliable measures of behavior of young children. Behavior was recorded as 'contacts' and divided into two groups of categories. If a child snatched a toy, struck a playmate, or commanded him, or if he attempted to force him in some way, such contacts were included under the term 'domination.' By such behavior he ignored the rights of the companion; he tended to reduce the free interplay of differences and to lead toward resistance or conformity in responding or adapting to another.
>
> "Other contacts were recorded which tended to increase the interplay of differences. Offering a companion a choice or soliciting an expression of his desires were gestures of flexibility and adaptation. These tended in the direction of discovering common purposes among differences. Such contacts were grouped under the term 'socially integrative behavior.'" (1, p. 12)

The findings of Anderson, et al. are based on the study of preschool, primary, and elementary school classrooms involving five different teachers and extending over several years. Taken altogether, their imaginative research has produced a series of internally consistent and significant findings. First, the dominative and integrative contacts of the teacher set a pattern of behavior that spreads throughout the classroom; the behavior of the teacher, more than any other individual, sets the climate of the class. The rule is that when either type of contact predominates, domination incites further domination, and integration stimulates further integration. It is the teacher's tendency that spreads among pupils and is continued even when the teacher is no longer in the room. Furthermore, the pattern a teacher develops in one year is likely to persist in his classroom the following year with different pupils. Second, when a teacher has a higher proportion of integrative contacts, pupils show more spontaneity and initiative, voluntary social contributions and acts of problem solving. Third, when a teacher has a higher proportion of dominative contacts, the pupils are more easily distracted from schoolwork, and show greater compliance to, as well as rejection of, teacher domination.

A year or so after Anderson started his work, Lippitt and White (5), working with Kurt Lewin, carried out laboratory experiments to analyze the effects of adult leaders' influence on boys' groups. The laboratory approach used had certain advantages in studying the effects of the adult leader's behavior. First, the contrasting patterns of leader behavior were purified and made more consistent as a result of training and role playing. Second, differences in the underlying personality and appearance of the adult leaders were minimized through role rotation. Third, the effect of the pattern of leader behavior was intensified, compared with a classroom, since there were only five boys to a group. Roughly speaking, the pattern Lippitt and White named "authoritarian leadership" consisted of dominative contacts; "democratic leadership" consisted of integrative contacts; while "laissez-faire leadership" consisted of irregular and infrequent integrative contacts with an element of indifference to the total group that is seldom found in a classroom and was not present in the Anderson et al. studies.

Most of the conclusions of the Lippitt and White study confirm or extend the general conclusions of Anderson et al. with some semantic modification but very little change, if any, in behavioral meaning. From the point of view of classroom teaching, one interesting extension was the conceptualization of "dependence on the leader" by Lippitt and White. This is a state of affairs in which group members were unable to proceed without directions from the leader. Anderson et al. used the category "conforming to teacher domination" and thus noted similar events, but in the more concentrated social climates of the laboratory experiments it was clearly seen that extensive compliance occurs when there is a generalized condition of dependence.

These two mutually supportive and independent studies aroused considerable interest in the notion of social climate. Additional research revealed minor variations of the central theme already established. Withall (6) showed that a simple classification of the teacher's verbal statements into seven categories produced an index of teacher behavior almost identical to the integrative-dominative (I/D) ratio of Anderson, et al. Flanders (7) created laboratory situations in which contrasting patterns of teacher behavior were exposed to one pupil at a time. A sustained dominative pattern was consistently disliked by pupils, reduced their ability to recall the material studied, and produced disruptive anxiety as indicated by galvanic skin response and changes in the heartbeat rates. The reverse trends were noted as pupil reactions to integrative contacts. Perkins (8), using Withall's technique, studied groups of teachers organized to discuss the topic of child growth and development. He found that greater learning about child growth and development occurred when group discussion was free to focus on that topic; groups with an integrative type of leader were able to do this more frequently than were groups lead by a dominative type of leader.

In a large cross-sectional study that did not use observation of spontaneous teacher behavior, Cogan (9) administered a single paper-and-pencil instrument to 987 eighth grade students in 33 classrooms that contained three scales: (a) a scale assessing student perceptions of the teacher; (b) a scale on which students reported how often they did required schoolwork; and (c) a scale on which students reported how often they did extra, nonrequired schoolwork. Cogan's first scale assessed traits which he developed in terms of Murray's list of major personality needs. There were two patterns in this scale. The items of one pattern were grouped as "dominative," "aggressive," and "rejectant." The second pattern was "integrative," "affiliative," and "nurturant;" these correspond to Anderson's dominative and integrative patterns. Cogan found that students reported doing more assigned and extra schoolwork when they perceived the teacher's behavior as falling into the integrative pattern rather than the dominative pattern.

Altogether these research projects support the statements about classroom climate that appear in the third paragraph of this section. The two teacher behavior patterns[1] that create the contrasting classroom climates by shifting the overall balance are shown on the next page.

---

[1] Most of the researchers cited have their own favorite words to describe essentially the same contrasting behavior patterns. Anderson _et al._: "dominative vs. integrative;" Lippitt and White: "authoritarian vs. democratic vs. laissez faire;" Withall, Flanders, Perkins: "teacher-centered vs. student-centered;" and Cogan: "preclusive vs. inclusive." For the sake of simplicity, Anderson's terms have been used in this review; the concepts "direct influence" and "indirect influence" will be introduced later.

The Integrative Pattern	The Dominative Pattern
a. Accepts, clarifies, and supports the ideas and feelings of pupils.	a. Expresses or lectures about own ideas or knowledge.
b. Praises and encourages.	b. Gives directions or orders.
c. Asks questions to stimulate pupil participation in decision making.	c. Criticizes or deprecates pupil behavior with intent to change it.
d. Asks questions to orient pupils to schoolwork.	d. Justifies his own position or authority.

Some implications of research on classroom climate:--One contribution of research on climate has been the identification of different kinds of verbal statements that a teacher uses to control class activities. These different types of statements were used to form categories for the technique of interaction analysis. The assumption of interaction analysis is that an observer can record each statement as it occurs fairly accurately, and after a period of time the resulting frequency distribution within categories represents the quality of teacher influence. A more complete description of interaction analysis as it was used in this study can be found in the next section of this chapter.

Two important questions are left unanswered by the studies just reviewed. First, since both integrative and dominative types of statements are used by all teachers, including the most excellent teachers, when and why should either type of influence be used? Second, what is an average balance of integrative and dominative acts found in our classrooms today?

The first question introduces the notion of flexibility of teacher influence. It points to the need for a dynamic theory of teacher influence that explains the short term effects of different patterns.

The second question stems from the observation that in Anderson's work, teachers classified as integrative and dominative differed from each other only in degree. There were some teachers with an above average and others with a below average integrative pattern, but what is average? Anderson and his co-workers present data for all their teachers (N=5), but grouped in such a manner that no standardized norms are easily identified. Furthermore, some of the verbal statements Anderson calls dominative are listed as integrative in our summary. The need for standardized norms remains.

One earlier research project does supply evidence that teachers are flexible in their use of integrative and dominative contacts. Mitzel and Rabinowitz (10) observed four teachers using Withall's technique and organized their data to permit an analysis of variance between teachers, visits and observers. Since the median length of an observer's visit was of the order of twenty minutes, the finding of statistically significant, wide variability of the integrative -dominative balance among visits for the same teacher suggest that teachers adapt their influence to the immediate situation.

A major goal of this present project is to explore flexibility and establish normative expectations for teacher influence.

Concepts and Theories of the Present Research

Concepts for describing teacher influence:--One difficulty with the words various researchers have chosen to represent different patterns of teacher behavior is the value judgment that the reader can infer. Domination stimulates a negative reaction in most teachers. Democratic is always considered superior to authoritarian. There may be no escape from this problem, but more objective words and definitions will help. Our thinking about teacher influence patterns began with a desire to choose different words to represent our concepts.

Let us assume that the teacher is placed in a position of authority not only by law, but by the expectations that students bring to the classroom. Normally, every action taken by a teacher becomes influential and if a teacher wishes to be temporarily less influential, he must make special plans to accomplish this.

The teacher controls his own influence primarily by using appropriate statements during spontaneous interaction. We assume that nearly all of the teacher's influence is expressed through verbal statements.

Next we assume that different types of statements will either increase or decrease the number of alternative actions available to the student. For example, a general question asked by the teacher presents more alternatives compared with telling the students to open their books to a particular page. This line of thinking leads us to the definitions of two concepts.

Direct influence by a teacher restricts the freedom of action of a student by setting restraints or focusing his attention on an idea.

Indirect influence by a teacher increases the freedom of action of a student by reducing restraints or encouraging participation.

There is a close, but not perfect, relationship between indirect statements and those called integrative in earlier research on climate. Similarly, direct statements are related to domination.

There are many different ways to increase or decrease the number of alternatives for action available to the students. The smaller work-group with a student chairman is less subject to the restraints of teacher control than is the total class with the teacher in charge. Some tasks have requirements that restrict the alternative student actions much more than other tasks. Age, sex, and personality characteristics also affect the actions of students in a specific situation.

The greater the variety of acts that a teacher uses to control the alternatives for student action, the harder is the job faced by a researcher who wishes to conceptualize and assess the process. Fortunately for the researcher, practically all classroom teachers restrict their acts of control to verbal communication. Most of the time teachers give assignments, discuss problems with the class, supervise the work of students, and in other ways retain a central position in the communication network. Whenever these conditions hold, a careful classification of the verbal statements of the teacher provides a reliable measure of the teacher's indirect and direct influence.

Our assumptions have been that an analysis of the teacher's verbal behavior is an adequate sample of his total behavior and that the most useful information about freedom of action can be inferred from what the teacher says. When a teacher accepts, clarifies, or makes constructive use of a student's ideas or feelings, when he praises or encourages student behavior, and when he asks questions, he will usually be increasing the freedom of action of the students. On the other hand, when a teacher expresses his own ideas, gives directions or criticism, and when he justifies his own use of authority, he will usually be decreasing the freedom of action of students.

The operational definition of direct and indirect influence used in this study is an enumeration of verbal communication within ten categories at continuous intervals of about three seconds by a trained observer. The exact procedures used are explained in a "Manual for Observers," which can be found in Appendix F, pp. 2-6 of this report.

Concepts for describing student dependence:--One way to start discussing student reactions to teacher influence is to postulate that dependence is always present in some degree in any teacher-pupil relationship. The maturity and power advantages of a teacher, reinforced by social expectations, are such that the student anticipates teacher direction and supervision. The student is more often ready to comply to teacher influence than not and when he does not comply, his anxiety increases because the teacher can control an effective system of rewards and punishments.

One way to describe the process of instruction is to say that the teacher strives to change the response pattern of a student from merely complying to an authority figure to more independent actions that are determined by the student's own analysis of the subject matter problems confronting him. This is a shift from an authority orientation to a content-problem orientation. A student who recognizes no learning problem is much more dependent on the teacher in deciding what is or is not acceptable behavior. On the other hand, a student hard at work on a problem responds to the problem requirements which form a set of criteria with which to evaluate his own behavior as well as teacher influence.

The first complication of this oversimplification is that students differ in their ability to give up their dependence on the teacher by shifting their orientation to the problem requirements. Some students cannot separate the problem requirements from teacher approval and continually seek teacher support at nearly all stages of their activities. We call such students dependent prone. Even the most skillful teachers find it difficult to stimulate self-directed problem solving among high dependent prone students. Dependence proneness is a personality trait that is established early in childhood and the extent to which it can be modified by school experiences is unknown.

Dependent behavior that occurs spontaneously in a classroom is only partly a function of the personality trait dependence proneness; it is also a function of the teacher's behavior. Certain patterns of teacher influence can force a student to respond with dependent behavior even though he is more independent and scores low on a test of dependence proneness. For example, the use of above average direct influence produces excessive compliance and conformity which reinforces high dependence.

In this study spontaneous dependent behavior must be distinguished from the personality trait dependence proneness. Both must be measured whenever this is possible.

Dependence proneness is measured by an attitude scale. Evidence of its reliability and validity, and the correlation of the scale scores with measures of I. Q. can be found in Appendix E of this report. We consider measures of dependence proneness fairly stable and use the scale primarily to classify students.

Dependent behavior that occurs spontaneously is much more difficult to measure. We were unable to develop a reliable system of observing spontaneous acts of dependence in either the first or second year of this project. During the first year, however, we did obtain a measure of the tendency to act dependently in a specific situation by adapting a technique first used by Filson (11). In the first year laboratory study, students were asked to indicate whether they would now like help from the teacher on several questions that formed a short scale. This was administered at three different points in the learning experiment and became a measure of dependence. The questions used for this purpose can be found in Appendix A, p. 19, items 1-3.

Concepts for describing learning goals:--Learning goals are usually described in terms of curriculum organization and content. In all classroom activities the learning of certain skills, understandings, or facts is central to a plan for which the teacher has ultimate responsibility. Content goals are often used to establish criteria for evaluating the teacher's plans and to design tests for measuring the effectiveness of classroom activities.

In this study the achievement of content goals is the major dependent variable of the research design. The essential question is this; when patterns of teacher influence create superior attitudes toward schoolwork, do the students show evidence of higher achievement?

In both the first and second year special achievement tests were constructed to evaluate the content of the learning tasks. These tests were administered three times: before learning, right after learning, and four to six weeks later as a measure of recall. Each test provided sub-scores covering recall of facts, understanding of principles or skill in solving problems and the application of knowledge to problems not used in teaching so that a more creative application of knowledge was required.

A total of four tests is involved. A copy of the first year test in geometry can be found in Appendix A, pp. 3-4; the first year test in social studies, Appendix A, pp. 1-2; the second year test in social studies, Appendix A, pp. 5-12; the second year test in mathematics, Appendix A, pp. 13-16.

Certain dimensions of learning goals, particularly the goal perceptions of the students and the teacher, can be conceptualized and measured without specifying the content involved. For example, the following dimensions of the students' goal perceptions seem independent of content. First, there is a dimension of motivation; how attractive and interesting are these goals? Second, there is a dimension of clarity; what are the steps necessary to reach a goal and what is the end product? Third, there is a dimension of realism; are the resources of time, ability and energy adequate to reach a goal?

In the present study the attractiveness and realism of goals have been uncontrolled. It was found that students were sufficiently interested in the first year learning tasks and the second year units of study to justify the assumption that this factor would not bias the results even if it did affect individual learning. The aspects of time, ability and energy were ignored because our pilot runs indicated that the schedule of activities provided adequate time, that the tasks permitted students of different ability to work, and that often the students had more energy than the research activities required.

The dimension of clarity of goals is a variable that is controlled in this study. This dimension can be conceived as a scale extending from ambiguous goal conditions to clear goal conditions.

A clear goal is defined as a state of affairs in which a student knows what steps are necessary to reach the goal and has a clear picture of the end product.

An ambiguous goal is defined as a state of affairs in which a student either is not sure of the steps necessary to reach the goal or has an uncertain picture of the end product.

Previously it was suggested that a student at work on a problem can use the problem requirements to guide his own behavior or to evaluate teacher influence. In either case he is less dependent on direction from the teacher. It seems reasonable to suppose that a student will benefit most from problem solving experiences when he works at the lowest level of dependence on the teacher that both he and the teacher can tolerate. For example, the lowest level necessary to co-ordinate classroom activities. A certain amount of dependence is desirable and will always be present in the classroom, but the teacher can and should control the general level of dependence by the appropriate use of teacher influence.

The level of dependence is a function of the student's dependence proneness, the restraints set by the teacher's pattern of influence, and the student's perception of the learning goal. In a specific situation the dependence proneness of the student is "given," fixed by the personality trait. The restraints set by the teacher are a function of his use of direct and indirect influence and the perception of this influence that is held by the student. When goals are ambiguous, the student is more likely to respond to teacher influence in a dependent fashion. When goals are clear, he can evaluate teacher influence by analyzing the intent of the teacher in terms of the problem requirements.

It takes time to establish a learning goal, to identify the steps of problem solving, and to begin work activities. During this period of time, clear goals gradually emerge from ambiguous goals. Because the student expects to comply to the teacher's authority, an expectation organized through past experience with authority figures, he is more likely to respond dependently. The natural tendency of a teacher, when faced with a situation in which goals are ambiguous, is to establish goals by using a pattern of influence that is primarily direct. This leads to higher levels of dependence that can interfere with self-directed problem solving. In effect, the average student must take into consideration both teacher demands as well as the demands of the problem. A dependent-prone student remains oriented to the demands of the teacher with even less regard for the demands of the problem. Dependence, once established under these conditions, is difficult to reduce.

It follows from this discussion that the teacher's choice of direct or indirect influence when goals are ambiguous is crucial to the control of dependence. This theory also suggests that the natural tendency of the teacher to establish goals with direct influence and the students' tendency to comply runs contrary to the conditions necessary for maximum learning. A test of this theory obviously requires the experimental control of the students' perception of the goal.

In the first year laboratory experiments the students' perceptions of the goals were manipulated at the time the basic content was introduced by a tape recording. In one treatment, students were warned that the information on the tape may not be relevant to their subsequent activities. This was said in order to create a degree of ambiguity. In the other treatments, the opposite perceptions were induced to create a degree of clarity. A questionnaire was used immediately after the induction and again after a discussion lead by the teacher to measure goal perceptions and possible changes that might occur. The questions used can be found in Appendix A, pp. 17-19 of this report.

In the second year, the students' perceptions of the learning goals were inferred from a time dimension. Goals were considered to be least clear during the first two days of a two week unit of study. Goals were considered to be clearer during the middle of the unit and most clear near the end of the unit. The notion that goals are least clear during the initial stages of a two week unit of study is quite defensible. At this time students are first learning about the topic, ways of organizing their own activities, and possible projects which may be carried out.

Concepts for describing teacher flexibility and homogeneous classroom activities:--Communication forms a continuous flow of ideas in spontaneous interaction. In most classrooms in Minnesota, the teacher talks more than all the students combined. Teacher influence continuously shifts from direct to indirect statements in a sequence of unending variety. Nevertheless, it is possible to analyze a teacher's statements over a reasonably short period of time and conclude that the teacher employed a pattern of influence that was above average, average, or below average in terms of either direct or indirect influence. Given a series of such episodes, one can ask how flexible is the teacher's pattern of influence?

Before this question can be answered, it is necessary to define an episode of classroom activity. This problem arose in the analysis of our second year field study involving the two week units of study in social studies and mathematics.

An observer, whose job is to classify periods of homogeneous activity for an hour or a two hour class period, can be trained to adequate levels of reliability. The criteria we used to recognize the end of one period and the beginning of another can be expressed by three questions. First, is the communication network changing its pattern? Second, is the structure or organization of the class changing? Third, is the content of communication shifting to a different topic or purpose? An affirmative answer to any one of these three questions caused an observer to make a special mark and a notation of the time. After the class observation is finished, the observer then indicates in greater detail just how one activity period differs from the next.

A system of categories for classifying periods of activity was developed by an analysis of the different episodes recognized by the observers. Initially 36 different activities were recognized, but further discussion by the research staff lead to the definition of four major categories of classroom activity. These categories are planning, work, evaluation, and administrative routine.

Planning included teacher-pupil planning or the teacher making assignments which the students were expected to carry out. Work included class discussion, lecture situations, individual seat work and other similar activities. Evaluation included tests, reports, correcting tests or homework and any discussion of work completed. Administrative routine included getting ready for work or cleaning up, activities not connected with the unit of study, and period of relaxation such as a break in the middle of a two hour period.

Closely connected with different kinds of activity is the notion of how time is spent. First, there is the question of how much time elapses in each type of activity. Second, one can conceive of an initial period comprising the first few days of a two week unit, a middle period after the students have a reasonable orientation to the unit, and a final period consisting of the last few days when a unit is terminated. Time, in the first instance, becomes a quantitative measure of the use of certain class activities. In the second instance, it becomes a method of distinguishing various phases of a two week problem solving experience.

Given a system for identifying homogeneous classroom activities, it is now possible to define teacher flexibility.

Teacher flexibility is the range of ratios of indirect influence to direct influence, calculated from all statements made within homogeneous activity periods, and then compared between the various types of classroom activities.

In other words, flexibility is a concept that refers to the teachers' tendency to use a different pattern of influence in different phases of the instructional process. An analysis of teacher flexibility answers a number of questions similar to: "Does this teacher use the same or a different pattern of influence when evaluating student work compared with introducing new material?"

Hypotheses of the Study

Three major hypotheses were listed in the proposal on which this study is based.

(1.0) Direct teacher influence restricts learning when a student's perception of the goal is confused and ambiguous.

(2.0) Direct teacher influence increases learning when a student's perception of the goal is clear and acceptable.

(3.0) Indirect teacher influence increases learning when a student's perception of the goal is confused and ambiguous.

It was proposed that the analysis of any data relevant to the support or rejection of these hypotheses be analyzed separately for gifted, average, and below average students. A Ph.D. thesis study, carried out by Dr. Edmund Amidon (12), permits us to report the analysis of data separately for students scoring high and low on the dependence proneness test for the first year laboratory experiments.

The first and third hypotheses are crucial tests of the theoretical explanation of why the teacher's influence must be carefully controlled when goals are ambiguous. A sub-hypothesis essential to one and three is that--(1:1) direct influence, when goals are ambiguous, increases dependent behavior. A second sub-hypothesis is that--(1:2) dependent-prone students will be more sensitive to changes in direct and indirect patterns of influence than are students who score low on the dependence-proneness test.

The second major hypothesis is more speculative in nature. It suggests that when goals are clear, direct influence will increase the learning of students. A sub-hypothesis supporting this explanation is that--(2:1) a student can use the requirements of a problem as criteria to evaluate the influence of a teacher. This last sub-hypothesis is not tested in the present study.

The second question that was raised at the end of the review of research on climate concerned normative expectations of teacher influence patterns. The present study will indicate the normative expectations that one can expect from seventh grade social studies teachers and eighth grade mathematics teachers within the category system used to assess teacher influence. The patterns that are reported should be considered no more than a report on current practice, but more will be said about this in later chapters of this report.

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Chapter Three

THE PROCEDURES, SAMPLING AND CONTROL VARIABLES OF THE FIRST YEAR EXPERIMENTS

This chapter will explain the research design and the procedures used in the first year. The samples and methods of sampling used will be discussed. Data will be presented to show that the independent or control variables satisfied the research design. The purpose of this chapter is to set the stage for the analysis of the dependent or outcome variables which follows in subsequent chapters.

The first year laboratory experiments were designed to study relationships between controlled teacher influence and its effect on dependent behavior among students. The laboratory approach was essential to the control of the students' goal perceptions and the assessment of dependence. Although measures of achievement are included in the first year's procedure, the probability of producing differences in achievement between experimental treatments based on only forty minutes of instruction is not very high.

A Description of the First Year Experiments

The experimental design:--Four experimental treatments comprise the first year design. In one-half of the groups a direct pattern of teacher influence was created. In the other one-half, an indirect pattern of teacher influence was used. The variable of teacher influence was manipulated by having a member of the research staff, who was an experienced teacher, practice controlling his behavior until he could present a consistent pattern of influence in spontaneous interaction.

The second independent variable was the students' perception of the learning goal. In one-half of the groups a condition of goal ambiguity was induced, and in the other one-half, a condition of goal clarity was induced. The design is illustrated in the diagram on the next page.

Teacher's behavior / Goal manipulation	Direct influence by the teacher	Indirect influence by the teacher
The learning task is initially ambiguous	Treatment I Each group size 20 balanced for I.Q. and sex	Treatment II Each group size 20 balanced for I.Q. and sex
The learning task is initially clear	Treatment III Each group size 20 balanced for I.Q. and sex	Treatment IV Each group size 20 balanced for I.Q. and sex

This same design was used for 560 students who worked on a geometry learning task and 480 students who worked on a social studies task. In the geometry experiments, seven groups of size 20 students were exposed to each treatment. In the social studies experiments, six groups of size 20 students were exposed to each treatment.

The experiments were conducted in a spare room of each participating school. Students were selected in advance from various home rooms, according to their I. Q. scores, and were excused from their regular classes in order to participate in the sessions that lasted approximately two hours and ten minutes. The particular sequence of treatments on a given day's run was arranged so that every possible combination occurred before the cycle repeated. This arrangement controlled the effects of morning versus afternoon participation for both the students and the experimental teacher. A single student participated in only one session. The same teacher taught all social studies sessions, another teacher taught all geometry sessions.

The procedure of each session:--The sequence of events was the same for geometry and social studies. The outline of the two hours and ten minutes is shown below.

OUTLINE OF EXPERIMENTAL SESSION

Period Length	Test or Questionnaire	Other Activities
I 50 min.	Booklet I--Achievement pretest of content Booklet II--Dependence proneness personality test	Orientation of students to experiment
II 15 min.		Teacher explanation establishing goal perception as clear or ambiguous. Tape-recorded lecture introducing content in clear or ambiguous style.
III 15 min.	Booklet III--First test of tendency to dependent behavior. First goal perception measure.	
IV 15 min.		Teacher-pupil discussion of the content, teacher influence either direct or indirect.
V 10 min.	Booklet IV--Second test of tendency to dependent behavior. Second goal perception measure. Measure of student's perception of teacher influence.	
VI 10 min.		Work period for seatwork with individual worksheet.
VII 15 min.	Booklet V--Second test of student's perception of teacher influence. Third test of dependent tendencies. Booklet VI--Achievement post test of content	

Following period VII the assistant teacher talked to the class about the importance of not telling the other students in the school about the experiment until after all experiments were completed in that school.

The learning tasks and content goals:--In both the social studies and the geometry experiments the content material was first introduced by a tape recorded lecture. The lecture playback was illustrated by maps in social studies, and by drawings in geometry, to which the teacher pointed when reference to these illustrations occurred in the narration. This procedure was used so that the material presented remained constant between experimental sessions. As already indicated, the manipulation of the students' goal perceptions was an integral part of the recording.

The content in geometry consisted of the formula for determining the circumference of a circle, $C = \pi D$; principles for determining the angles at the intersection of two straight lines; and relationships between the arcs and inscribed angles of a circle. The presentation of three basic formulae and their application to simple problems moved rather fast and was somewhat advanced for most of the students who participated. The seatwork in geometry was a problem set involving an aircraft carrier steaming in a circle several miles from a destroyer that was aground on a reef. Helicopter flights were being made from the carrier to rescue men from the destroyer. The questions asked the student to determine what compass course the helicopter would fly when returning to the aircraft carrier as it continued to steam in a circle. (See Appendix B, pg. 1)

The content of the social studies sessions was largely in the field of geography. The tape recording dealt with how the factors of climate, transportation, and occupations affected the location and growth of cities. The lecture gave specific examples in the United States. During the work period students were required to apply the principles to an imaginary new continent. (See Appendix B, pp. 1-2)

A subjective appraisal of the experimental sessions would suggest that more students were having difficulty with understanding the geometry content compared with the content in social studies.

The Sampling Procedures of the First Year

The students who participated in the first year experiments were chosen by methods that would make the experimental population reasonably representative of urban eighth grade students. Eight junior high schools were selected by using a table of random numbers from a total population of 13 schools. The counselors in each school scheduled as many groups of size 20 as possible. The limitation in upper socio-economic areas was the number of students whose I. Q. was below 95, in the lower socio-economic areas the limitation was the number of students whose I. Q. was above 115. No school was allowed to schedule all of their students because a small reserve at all I. Q. levels was necessary to cover students who were absent on the day of the experiment. Every time a scheduled experiment began there were exactly 20 students, even though one or two might have been last minute substitutes. Substitutes were always made within the I. Q. quartile range of the missing student.

A total of 560 students participated in the geometry experiments and 480 students participated in the social studies experiments. With excellent cooperation, planning, and a tight schedule, all experiments were completed within a 20 day period by two data collecting teams.

The eighth grade was chosen as a compromise between two opposing factors. The older a student, the more likely he could read and understand the longer attitude tests without taking too much time. The younger the student, the easier the task of finding instructional materials covering content that would be new.

The schools not chosen in the original sample provided the eighth grade students necessary to validate the dependence proneness test which was also developed during the first year.

The Control Variables of the First Year Experiments

A test of the major theoretical hypotheses depends on successfully creating the four treatments specified in the experimental design. In Treatment I it must be shown that the teacher was direct and the initial goal perceptions of the students were ambiguous. Similarly, the conditions specified in Treatments II, III, and IV must be shown to exist.

In this section the methods used to create the experimental conditions and the evidence of success or failure will be discussed.

The analysis of the control variables will be made separately for five groups. Three of the five groups have no overlap. These are the above average I.Q. students, the average I.Q. students, and the below average I.Q. students. The total number of students involved in these three groups represents the entire experimental population for a single content area. The other two groups are the students who scored in the top 25% of the dependence proneness test and those who scored in the bottom 25%. Assignment to these last two groups was made without regard to I.Q. score.

It is necessary to analyze the control variables separately for these five groups because the same breakdown is used with the outcome variables.

The control of teacher influence:--The first step leading to the effective control of the teacher's spontaneous behavior in this experiment was to select a person who could be trained to provide the desired pattern of influence. We carried out a number of pilot runs in which our experimental teachers practiced being consistently direct or indirect. Tape recordings of their performance were analyzed.

Although the evidence about to be presented will show that the control of teacher influence was successful, we feel that additional training should have been carried out before the first experiments. The role consistency of the teachers was still improving during the early experiments.

The experimental control of spontaneous behavior cannot depend on the intent and training of the role player alone. Two types of evidence were collected to make sure that the direct and indirect patterns were present. First, a complete interaction analysis of the discussion in period IV was made by the assistant teacher who was a trained observer. Second, a brief scale to measure the students' perception of teacher influence was administered in periods V and VII of each experimental session, Appendix B, pp. 7-8.

First, data from interaction analysis[1] will be considered. Table One shows the per cent distribution within the ten categories during the period of discussion (period IV) in which the teacher presented a direct or indirect pattern of influence.

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[1] In order to conserve space in the main body of this report, the complete description of interaction analysis is set forth in Appendix F, which consists of a research monograph called, "Interaction Analysis in the Classroom--An Observer's Manual."

Table One

PER CENT OF TALLIES IN INTERACTION CATEGORIES DURING PERIOD IV

CATEGORIES		Geometry Experimental Treatment				Social Studies Experimental Treatment			
		I	III	II	IV	I	III	II	IV
Indirect Teacher Talk	1,2	1.61	1.35	14.90	17.04	--	0.14	8.45	7.98
	3	0.92	2.48	16.10	15.78	2.74	1.97	14.24	16.34
	4	1.73	2.58	30.04	28.07	3.16	3.52	20.90	22.60
Direct Teacher Talk	5	61.40	63.10	15.97	13.52	70.80	71.40	27.25	23.58
	6	10.36	8.67	0.27	0.28	4.12	5.50	2.66	1.60
	7	15.54	13.03	0.94	1.27	6.17	6.48	0.85	0.61
Student Talk	8,9	5.07	5.29	17.17	16.47	10.00	5.78	22.95	25.30
Silence	10	3.45	3.49	4.69	7.75	0.41	5.08	2.65	2.22
TOTAL TALLIES		869	889	746	711	730	709	828	815

The per cent figures are based on the total which is formed by adding all tallies for identical treatments. An analysis of these data provides the answer to two questions: first, did the teachers accidentally adjust or bias their influence patterns between the clear and ambiguous goal treatments? and second, what are the differences between the direct and indirect patterns of teacher influence? Each of these questions will now be discussed.

The best test of the null hypothesis that there are no differences in teacher influence between the clear and ambiguous treatments makes of Darwin's Chi-square procedures outlined on pp. 4-6 of Appendix B and p. 26 of Appendix E. The test is made separately for geometry and again for social studies and requires the original 10 X 10 matrices, the column totals of which are shown in Table One as per cents.

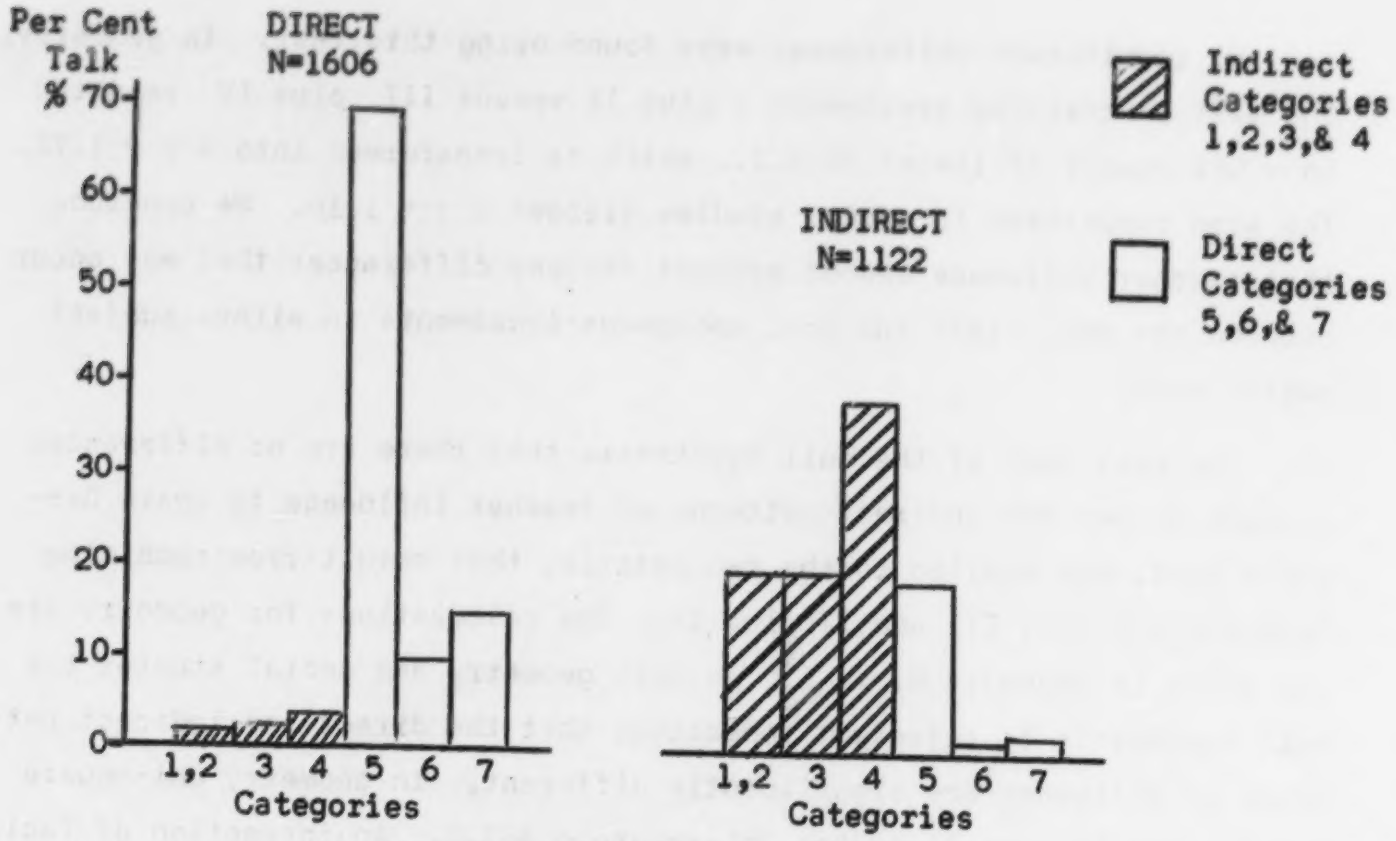
No significant differences were found using this test. In geometry, the test contrasting treatments I plus II versus III plus IV resulted in a Chi-square of 114 at 90 d.f., which is transformed into a $z = 1.72$. The same comparison in social studies yielded a $z = 1.16$. We conclude that teacher influence cannot account for any differences that may occur between the goal clear and goal ambiguous treatments in either subject matter area.

The best test of the null hypothesis that there are no differences between direct and indirect patterns of teacher influence is again Darwin's test, but applied to the two matrices that result from combining treatments I plus III and II plus IV. The calculations for geometry are all shown in Appendix B, p. 6. In both geometry and social studies the null hypothesis is rejected, indicating that the direct and indirect patterns of influence are significantly different. In geometry Chi-square = 702.3 and in social studies Chi-square = 482.0. An inspection of Table One indicates that this difference is clearly in the predicted direction.

Figures One and Two are histograms showing the distribution of teacher statements, categories one through seven, by per cent. The total "N" indicated is the total number of tallies recorded during the direct and indirect treatments. These profiles show the qualitative differences of teacher influence created in the geometry and social studies experiments.

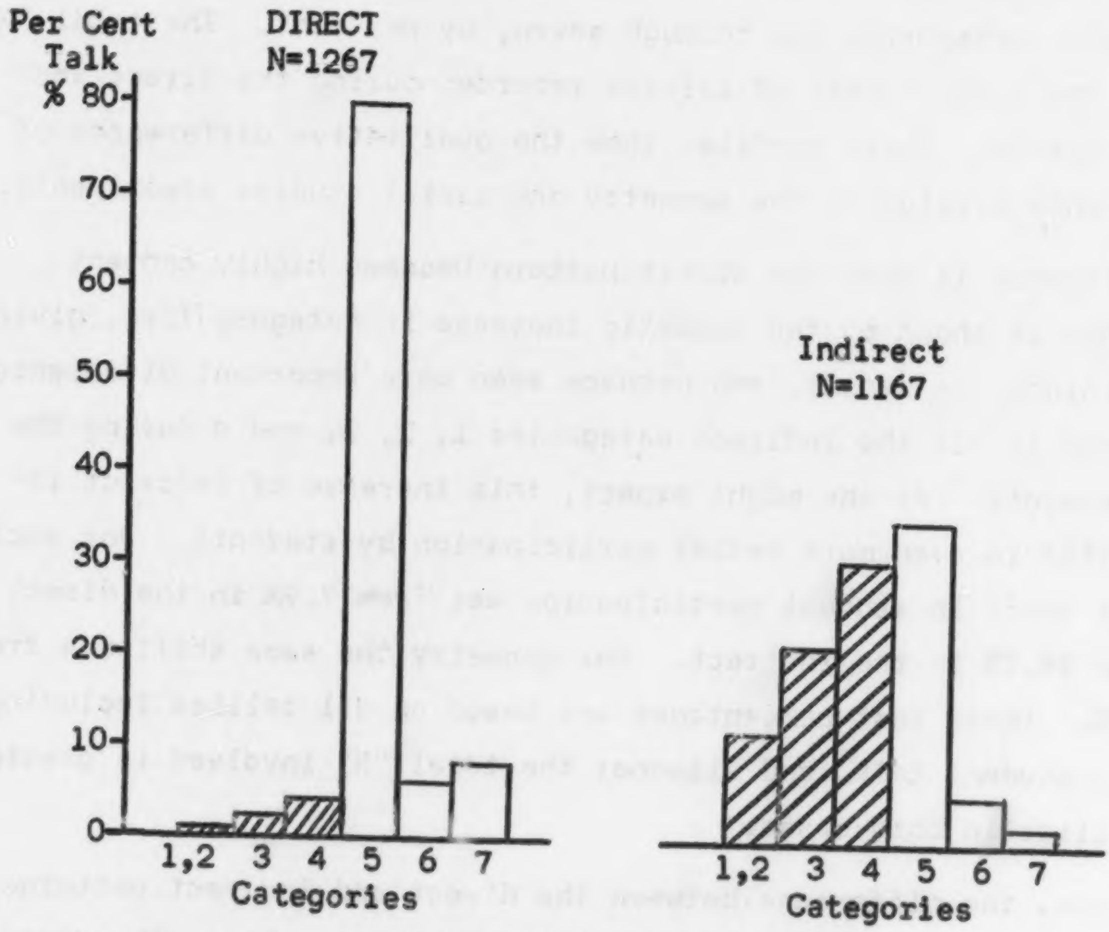
One difference is that the direct pattern becomes highly content oriented. This is shown by the dramatic increase in category five, giving facts and opinions. A second, and perhaps even more important difference, is the increase in all the indirect categories 1, 2, 3, and 4 during the indirect treatments. As one might expect, this increase of indirect influence resulted in even more verbal participation by students. For social studies, this shift in student participation was from 7.9% in the direct treatments to 24.7% in the indirect. For geometry the same shift was from 4.9% to 16.9%. These last percentages are based on all tallies including teacher talk, student talk, and silence; the total "N" involved is greater than 1400 tallies in both cases.

In essence, the difference between the direct and indirect patterns in this experiment is in the central position of the teacher. The direct pattern is close to what the average instructor would call lecture with



Teacher Influence--Geometry

Fig. 1



Teacher Influence--Social Studies

Fig. 2

questions to check on the students' understanding of what was said. The indirect pattern shows a genuine effort to encourage student participation even though the strangeness of the teacher-pupil relationship and the highly organized program tended to inhibit the students.

We now turn to the assessment of teacher influence made by the students. Our purpose here is to show that in addition to the differences in teacher influence that a trained observer can record, the students also could distinguish direct from indirect influence.

Three questions were printed in Booklet IV to measure the students' awareness of the teacher's influence pattern. The student indicated his answer on a nine point scale. His three responses were added to form a combined score. The questions were: a) does this teacher talk more than the students? b) how often does this teacher use the students' suggestions and ideas? and c) how often does the teacher criticize the students?

The reliability of these scores was calculated by the Hoyt-Stunkard (1) method. In the social studies groups the reliability was 0.80 with a standard error of 2.70. In the geometry groups the reliability was 0.64 with a standard error of 2.75. An analysis of variance was made of sources of variance between the four treatments for the scores from the three questions. This analysis was carried out ten times: once for above average I.Q. students, average I.Q. students, below average I.Q. students, students scoring high on dependence proneness, and students scoring low on dependence proneness in social studies, repeated for geometry. The tables showing the individual analyses have not been included in this report to conserve space. Copies are available upon request from the author. The differences associated with teacher influence were significant at the 0.01 level in all ten analyses in the predicted direction. The means and differences are shown in Table Two on the next page.

The three questions are keyed so that the lower the score, the more the student sees the teacher as direct. The consistent significant differences for all groups indicates that the direct and indirect patterns were noticed by the students.

The largest mean differences in both geometry and social studies are reported by above average I.Q. students and students who scored high on the dependence proneness test. The lowest mean differences are reported by the below average I.Q. group. We are inclined to interpret these trends by asserting that an above average I.Q. student can make more consistent and penetrating observations of teacher behavior and that the high dependent prone student pays more attention to teacher behavior.

We consider that the conclusions from the interaction data, supported by measures of the student perceptions, provide adequate evidence of the successful control of teacher influence in a manner consistent with the experimental design.

Table Two

STUDENT PERCEPTIONS OF TEACHER INFLUENCE

GROUP ANALYZED	INDIRECT MEANS*	DIRECT MEANS*	MEAN DIFFERENCE	LEVEL OF SIG.
Social Studies				
Above Average	20.16	10.86	9.30	.01
Average	18.18	12.02	6.16	.01
Below Average	17.10	12.78	4.32	.01
Independent	18.22	11.37	6.85	.01
Dependent	19.52	12.00	7.52	.01
Geometry				
Above Average	18.42	11.71	6.71	.01
Average	17.37	12.18	5.19	.01
Below Average	17.13	15.04	2.09	.01
Independent	16.84	12.28	4.56	.01
Dependent	18.48	13.18	5.30	.01

*The lower the score, the more direct

The control of the students' goal perceptions:--It was stated in the last chapter that the difference between clear and ambiguous goals is determined by two aspects of the student's perception: first, knowing the steps necessary to reach a goal and second, knowing what the end product will be. Note that it is the student's perception, not the teacher's, that is of concern here.

For over four years we have found it difficult to obtain any measure of goal perception from students under field conditions. Either we haven't been clever enough, or red-blooded American students avoid admitting that they do not know what they are doing. Part of the trouble concerns semantics. When a student is asked if he knows what he is doing, at the very least he can say, "Sure. I'm studying my math homework." When questionnaires are purposely designed to be content free, the semantic problem becomes most difficult.

Four questions were used as a measure of goal perceptions. They were administered in period III, right after the tape recording, and in period V, right after the teacher-student discussion. The questions concerned what a student thought he was doing and whether he knew how to go about it; see Appendix A, p. 17. The reliability of this four question scale in the social studies experiments was 0.88, with a standard error of 2.63. In the geometry experiments it was 0.93 with a standard error of 1.77. The reliability analysis was made by the Hoyt-Stunkard (1) method.

An investigation of this control variable can be carried out by testing the null hypothesis that there are no differences among the four treatments with respect to measures of goal perception. This can be done most effectively by an analysis of variance. The analysis was made separately for the same five groups that were mentioned in the previous section. Five analyses were made for geometry and five more were made for social studies on the first measure. This was repeated for the second measure, making a total of twenty. The twenty tables showing the analyses of variance have not been included in this report to conserve space. Copies are available from the author upon request.

The method of inducing the perception of clear or ambiguous goals has already been mentioned. The only variation was that the geometry teacher, on his own initiative, regularly reinforced the induction by making a statement before the recording; this was not done in the social studies experiments.

Table Three shows the five group means in social studies on the first and second measures of the students' goal perception in the clear and ambiguous treatments. Table Four shows the same data for the geometry experiments. The level of significance is determined by the analysis of variance, and refers to the clear-ambiguous contrast. The scale is keyed so that the higher the score, the more ambiguous is the perception.

Table Three

GOAL PERCEPTION MEANS IN SOCIAL STUDIES

GROUP ANALYZED	First Measure			Second Measure		
	Clear	Sig. Diff.	Ambig.	Clear	Sig. Diff.	Ambig.
Above Average I.Q.	19.21	.05	22.05	14.50	.05	17.35
Average I.Q.	20.13	.01	23.17	16.61	.01	19.64
Below Average I.Q.	22.50	(.06)	24.86	20.13	N.S.	22.65
High Dependent	18.95	N.S.	21.50	15.12	N.S.	17.27
Low Dependent	22.67	N.S.	24.97	16.75	.01	22.00

Table Four

GOAL PERCEPTION MEANS IN GEOMETRY

GROUP ANALYZED	First Measure			Second Measure		
	Clear	Sig. Diff.	Ambig.	Clear	Sig. Diff.	Ambig.
Above Average I.Q.	19.58	.01	23.28	15.75	N.S.	17.42
Average I.Q.	23.61	.01	26.92	20.00	.01	23.53
Below Average I.Q.	26.09	.05	28.12	25.19	N.S.	26.71
High Dependent	21.40	.01	26.12	17.85	.01	22.09
Low Dependent	24.57	.01	27.95	22.40	N.S.	24.00

The evidence for social studies in Table Three indicates significant differences in the required direction for the entire experimental population--see the above average, average, and below average groups--at a level of confidence that varies between 0.01 and 0.06 on the first measure. For the same groups in geometry, Table Four also indicates significant differences on the first measure. When students are selected on the basis of their scores on the dependence proneness test, only those in the geometry experiments show significant differences in the desired direction on the first measure. Our conclusion is that the manipulation of the students' goal perception was not as successful as we would have wished. The evidence is stronger for geometry than it is for social studies.

Two expected trends in goal perception take place between the first and the second measures. First, differences between the ambiguous and clear treatments become less marked, although all non-significant differences maintain the same trend. Second, an inspection of the analysis of variance tables indicates that the F ratios for teacher influence and the interaction of teacher influence with goal perception grow larger and in some cases become significant. Table Five indicates those F ratios which attain significance.

Table Five

RELATIONSHIP OF GOAL PERCEPTIONS TO TEACHER INFLUENCE ON SECOND MEASURE

GROUP ANALYZED	INTERACTION	INFLUENCE
Social Studies		
Low Dependent	.05	(0.06)
Geometry		
Average I.Q.	0.01	0.05
Below Average I.Q.	0.05	0.01
High Dependence	N.S.	0.01

One would expect that teacher influence would affect the second measure of the students' goal perceptions because the class discussion with either a direct or indirect pattern of influence occurred between the first and second goal perception measures. The increase in F ratios for teacher influence and a decrease in the F ratios for goal perception show this

Unfortunately, there are no consistent patterns between treatments. As far as increasing goal clarity is concerned, there is a slight non-significant advantage to the indirect treatments. The means by treatment at the second measure of goal perception are, in rank order of clarity: indirect clear--15.94; direct clear--19.77; indirect ambiguous--20.34; and direct ambiguous--23.71. A test of the significance of differences between means shows that the indirect clear and the direct ambiguous are significantly different from all other means. Apparently, at the time of the second measure of goal perception, goals were clearest in the indirect clear treatment and most ambiguous in the direct ambiguous treatment.

By way of summary, it appears that the manipulation of goal perceptions was successful, but the induction was more potent in the geometry experiments in which the teacher reinforced the tape recording.

The control of sex and I.Q.:--The schools participating in the first year experiments agreed to supply twenty boys and girls for each experimental session at the appointed time and place. The school counselors were asked to assign an equal number of boys and girls to each session. However, they were told that sex balance was less important than maintaining the following distribution of I.Q. in each experimental group; five students from the upper quartile in I.Q., ten students from the middle two quartiles, and five students from the bottom quartile.

All I.Q. scores were obtained from a Kuhlmann-Finch group test administered six weeks before the experiments were conducted. Ten analyses of variance, for the same basic groups, were made to determine if the distribution of I.Q. among treatments might influence the results. These analyses have not been included in this report to conserve space. Copies are available from the author upon request. Although in one F ratio a significance of 0.01 was attained and another of 0.05, it was concluded that no differences in I.Q. would bias the results of the first year experiments.

Table Six shows the I.Q. means for the five basic groups in social studies and geometry.

Table Six

MEANS OF I.Q. BY GROUPS

GROUP	SOCIAL STUDIES	GEOMETRY
Above Average I.Q.	124.35	123.08
Average I.Q.	105.48	104.93
Below Average I.Q.	91.58	91.13
High Dependent Prone	108.83	110.77
Low Dependent Prone	106.31	103.52

An analysis was made to see if the number of boys was significantly different from the number of girls between the four treatments for each of the five basic groups. A Chi-square analysis was made of the ten two-by-four contingency tables representing the sex distribution. In no case did the Chi-square values approach significance. These analyses have not been included in this report in order to conserve space. The distribution of boys and girls in the various groups cannot be a factor that biases the results.

Summary of the first year control variables:--In a laboratory design, the burden of proof concerning experimental control lies with the researcher. In this study it has been shown that when the design called for direct or indirect influence from the teacher, the required pattern occurred. Further supporting evidence about teacher influence was secured from the students and from trained observers. Similarly, the design required a manipulation of the students' perceptions of the learning goals; evidence was provided to show that these manipulations were reasonably satisfactory.

The more general variables of I.Q. and sex distribution were distributed in such a fashion that they could not reasonably bias the results of the study. The factor of teacher personality was equalized by having the same teacher for all geometry experiments and another teacher for all social studies experiments.

References

1. Hoyt, C.J., and Stunkard, C. L. Estimation of Test Reliability for Unrestricted Item Scoring Methods. Educa. & Psychol. Measurement, 1952, No. 4, 12, 756-58.

Chapter Four

THE PROCEDURES, SAMPLING AND CONTROL VARIABLES OF THE SECOND YEAR EXPERIMENTS

The second year of this study was a shift from the controlled conditions of laboratory research to the semi-controlled conditions of a field experiment. In the first year students were selected to be approximately equal in ability and range of individual differences; in the second year we took classes as they were. In the first year a trained teacher provided a specific pattern of influence; in the second year teachers followed their natural patterns of influence. With the loss of laboratory precision there was a gain of being able to generalize about the current practices of teachers and the possibility of showing that the same theories could apply to laboratory and field alike.

The second year consisted of having 32 mathematics and social studies teachers teach a two week unit of study. Teacher influence was controlled by measuring the spontaneous interaction patterns of the teachers; the data were tabulated separately for different class formations and purposes. Achievement of the students was an outcome variable measured by pre-and-post tests. The materials of instruction were approximately constant because they were supplied by our staff.

The sampling, procedures and methods used to control teacher influence, goal clarity and other independent variables will be discussed in this chapter.

A Description of the Second Year Field Experiments

The procedure of the second year:--The first step was to consult with the curriculum specialists of the Twin Cities school systems in order to locate units of study that could be adapted to both systems.

The mathematics unit was the easiest to design since an expansion of the short lesson of the first year proved feasible. The unit, as expanded, was normally scheduled in the ninth grade or higher in both school systems. This meant that classes participating in March would face material that was just as new to them as it was to the classes participating in December. It was decided that eighth grade mathematics classes would be the appropriate grade level.

The social studies unit proved more difficult. The first problem arose because the normal content covered in the seventh and eighth grades of the two city school systems was quite different. Furthermore, the methods of unit organization and patterns of teaching were quite different, even between schools in the same city. The solution to these difficulties was to select a remote country for study; one that was not usually covered in either city. The grade level finally chosen was the seventh grade, since in both cities, countries other than the United States were usually studied.

The second step was to decide how teachers would be selected. Two requirements governed the procedure. First, it was necessary that the natural style of some of the teachers include an above average proportion of direct influence while others should be above average in the use of indirect influence. Second, the number of teachers at either extreme should be equal so that the average of both extreme groups could approximate the average of all teachers. If these two requirements were satisfied, then we could be sure of contrasting styles of teaching and, at the same time, be able to generalize the findings to the population from which the teachers were selected.

The third step was to build the two units of study. In both mathematics and social studies most of the material was written and mimeographed by our research personnel. The objective was to have enough material for 35-40 students, to make sure that some material was appropriate to slow and fast readers, and that the material could be used with equal effectiveness by either formal or informal teachers. Enough material for three classes in both mathematics and social studies was gathered together.

The fourth step was to train observers in the technique of interaction analysis until the errors due to differences between observers was very small compared with the differences among teachers. Once trained, it was necessary to maintain reliability from December through March by having regular meetings of the observers to discuss ground rules and special problems of classification.

The fifth step was to schedule 32 units of study so that our three observers could be assigned to the first two days of every unit and the last few days with additional visits so that there was a total observation of six hours in mathematics and ten to twelve hours in social studies for each teacher. Schedules were continually adjusted due to teacher absences, interruptions for school-wide activities, and other emergencies.

The sixth step was to arrange for all data to be punched on I.B.M. cards and to coordinate statistical analysis between our office staff and the personnel of the I.B.M. center.

The two week units of instruction:--The purpose of developing the material to be used in the two week units was to make sure that the resources of all teachers at the beginning of each unit were as identical as possible. Our aim was to provide each teacher with sample copies of all materials at least two weeks before the unit was scheduled to start. A few days before initiating the unit, enough material for an entire class was brought in boxes to each teacher's room. The only material that was not shown to teachers before or during the unit was the pre- and post-achievement test. This precaution was taken to avoid having teachers schedule their activities on the basis of the particular items that appeared in the test.

In mathematics each teacher received 35 copies of "Booklet One" and "Booklet Two" which introduced the major algebraic and geometric concepts, listed possible problem assignments, included review sections and was organized in a style that was similar to a mathematics text book. Three separate worksheets for special projects that required the application of geometry were supplied in sufficient quantity for the entire class. Two self-directing review booklets were included for the students who could work mcre independently.

The mathematics teacher was free to introduce the unit in any manner he wished. He could set a daily routine or vary the schedule to include group projects. No quick review tests were included; each teacher was left to his own devices in this area. No teacher complained of too little material; several commented that the material was too advanced or that there was too much to cover in two weeks.

In social studies the materials were more varied. The basic materials for 35 students included specially mimeographed selections from books on the history, exploration and development of New Zealand. In addition, the Department of Education, Wellington, New Zealand, provided us with quantities of elementary school "readers," upon our request, so that cultural, historical, and geographical information about New Zealand was available at reading levels that were as low as the third grade level. Travel posters, filmstrips, and records of Maori music were supplied for special demonstrations or displays. There were no restrictions placed on any teacher regarding the use of additional materials from school libraries, but in general, the only library materials available were for the general topic of the "South Pacific." Most teachers expressed enthusiasm for the careful preparation of the New Zealand materials.

The uniqueness of the content plus the control that followed automatically from our promise to supply all necessary materials provided an equality of resources among classes at the beginning of a unit.

The Sampling Procedures of the Second Year

The population sampled in the second year experiments might best be described as teacher-class situations. The teachers were not the sole object of our sampling; it was the teacher plus the students, the total classroom situation.

The major purpose of sampling was to select about sixteen teacher-class units in which there would be a wide range of teacher influence yet the average characterisitcs of the entire sample would be generally representative of the two school systems. These conditions can be met by selecting classes that are equally extreme on some scale that is correlated with teacher influence.

The Minnesota Student Attitude Inventory is an attitude test which has shown a significant correlation in earlier studies with the teacher's pattern of influence. For the present a study a shortened form of the test was used. The test is made up of items that reflect the students' attitudes toward the teacher, the class activities, the teacher's system of rewards and punishments, and their dependence on the teacher. A copy of the short form may be found in Appendix C, pp. 1-3, Items 1-34.

We found that there were 63 seventh grade English/social studies teachers and 85 eighth grade mathematics teachers in 13 junior high schools in Minneapolis and St. Paul. Most of these teachers taught more than one class, but we decided not to select two classes with the same teacher. From each of these groups 50 teachers were selected at random by the use of a table of random numbers.

We arranged to contact these 100 teachers in small regional meetings at which we described the project and solicited their participation on a voluntary basis. The teachers were told that if they agreed to participate, they might be asked to teach a two-week unit later on in the year, and that only 32 teachers would teach units so the chances were about two out of three that their participation would be limited to having a test administered in their class.

Not all of the 100 teachers agreed to participate. Thirteen social studies teachers and twelve math teachers dropped out for a variety of reasons. The short form of the Minnesota Student Attitude Inventory was administered to 37 social studies classes and 38 mathematics classes in the Twin Cities. The frequency distribution of all students in both content areas is shown in Table Seven.

The distributions in both content areas are badly skewed. There is, in effect, too low a ceiling on the test indicating poor discriminating power at the high end of the scale. These distributions gave us something of a shock because they revealed an error in judgment which could not be corrected due to the pressure of time.

The error in judgment was that we had reduced the M.S.A.I. total number of items from 68 to the 30 most discriminating items by the use of a standard internal consistency, item analysis procedure. With only 30 items and an "agree-disagree" response, the scaling power of the test was seriously impaired. To make matters worse, there was no time to repeat the tests using longer, older forms of the M.S.A.I. since the dates scheduled for teaching the first units were close at hand.

The distribution of class means is shown in Table Eight for both content areas. As one might predict from Table Seven, the test is not making distinctions between classes at the high end of the distribution as well as it is at the low end.

Table Seven

DISTRIBUTION OF SCORES,
M.S.A.I., SHORT FORM

Raw Score X	Soc. Stud. f.	Math. f.
30	1	-
29	29	24
28	43	58
27	83	77
26	90	102
25	114	103
24	116	94
23	89	101
22	86	82
21	67	79
20	66	67
19	57	54
18	45	47
17	38	38
16	33	36
15	24	31
14	22	16
13	14	15
12	14	14
11	11	13
10	15	5
9	6	5
8	4	3
7	5	2
6	2	3
5	1	3
4	1	1
3	1	-
N	1077	1073
$\bar{x}$	21.52	21.62
σ^2	23.02	21.76

Table Eight

DISTRIBUTION OF MEANS BY CLASS,
M.S.A.I., SHORT FORM

Class Interval	Soc. Stud. f.	Math. f.
25.0-25.4	2	-
24.5-24.9	-	4
24.0-24.4	1	3
23.5-23.9	3	3
23.0-23.4	4	5
22.5-22.9	3	1
22.0-22.4	5	6
21.5-21.9	4	1
21.0-21.4	4	3
20.5-20.9	2	3
20.0-20.4	2	2
19.5-19.9	2	1
19.0-19.4	2	2
18.5-18.9	2	1
18.0-18.4	-	-
17.5-17.9	1	-
17.0-17.4	-	2
16.5-16.9	-	-
16.0-16.4	-	-
15.5-15.9	-	1
N	37	38
$\bar{x}$	21.52	21.62

Tables Nine, Ten,Eleven and Twelve show the eight classes selected to teach the two week units from the high and low ends of the distributions. The total "N" used to calculate the mean represents the number of students in the class the day the test was administered. The code numbers used indicate the school by letter, the first digit indicates either the eighth or seventh grade, the next two digits indicate the number of the teacher-class unit within a school. Throughout this report code numbers in the "800" series refer to mathematics classes, the "700" series refers to the social studies classes.

An inspection of the variances of the class distributions indicates that some classes have much less homogeneity of opinion concerning the attitudes being measured. The grouping of classes with significantly different variances may be questioned, but within the limits of the experimental design the alternative methods of classification are even less desirable.

A simple critical ratio is a satisfactory method of testing the significance of the differences between the means of the high and low groups when the "Ns" are larger than 200. For mathematics, a critical ratio of 9.8 was calculated which shows that the mean of all classes scoring high on the M.S.A.I. was significantly different from the mean of all classes scoring low. A similar analysis for social studies produces a C.R. = 12.6 One would expect these ratios to be significant when extremes of a distribution are being compared.

We turn now to a summary of the sampling procedures of the second year.

How representative is this sample? The total of 32 teachers used in social studies is a 50 per cent sample, in mathematics a 36 per cent sample. The procedure did identify teachers whose natural style was direct and others who were indirect in both mathematics and social studies. The patterns of interaction analysis found in the present sample are similar to those found in earlier research. We believe that our sample is representative of urban teachers at this grade level and subject matter area.

What effect will the short form of the test have on the second year experiments? The major function of the test was to select teachers whose

Table Nine

CLASSES SELECTED FOR TWO-WEEK UNITS IN MATHEMATICS FROM HIGH END OF THE M.S.A.I. DISTRIBTUION

Teacher's Code Number	Class "N"	Class Mean	Class Variance
C 801	26	24.81	7.19
P 805	34	24.62	13.30
G 801	22	24.59	4.28
L 803	20	24.55	8.45
M 805	31	24.35	10.53
I 801	24	24.29	10.13
D 804	34	23.79	14.83
M 802	27	23.11	19.49
Totals	218	24.24	11.85

Table Ten

CLASSES SELECTED FOR TWO WEEK UNITS IN MATHEMATICS FROM LOW END OF THE M.S.A.I. DISTRIBUTION

Teacher's Code Number	Class "N"	Class Mean	Class Variance
A 802	26	20.73	15.62
E 802	24	20.04	29.36
T 802	24	19.83	13.85
V 804	26	19.31	18.81
G 802	24	19.25	16.19
A 803	30	18.80	25.96
V 803	32	17.47	23.33
H 802	35	17.11	31.51
Totals	221	18.92	23.94

Table Eleven

CLASSES SELECTED FOR TWO WEEK UNITS IN SOCIAL STUDIES FROM HIGH END OF THE M.S.A.I. DISTRIBUTION

Teacher's Code Number	Class "N"	Class Mean	Class Variance
R 701	32	25.47	7.44
P 703	29	25.00	7.31
P 701	32	24.13	17.55
N 702	29	23.90	11.45
G 703	30	23.80	20.43
H 704	27	23.55	12.88
D 708	28	23.46	7.67
M 701	30	23.43	10.87
Totals	237	24.11	12.69

Table Twelve

CLASSES SELECTED FOR TWO WEEK UNITS IN SOCIAL STUDIES FROM LOW END OF THE M.S.A.I. DISTRIBUTION

Teacher's Code Number	Class "N"	Class Mean	Class Variance
B 704	29	20.41	30.26
Q 701	30	19.57	32.32
D 706	32	19.53	19.36
A 701	29	19.45	24.32
R 702	28	19.21	25.69
F 701	30	18.73	28.39
C 704	30	18.60	14.51
L 706	36	17.78	20.93
Totals	244	19.12	24.98

patterns of influence would be different. Our concern with the results of the M.S.A.I. was based on the possibility that it had not performed this function as well as it might. To whatever extent this function is not fulfilled, to that same extent the total field experiment becomes a more severe test of the theory and hypotheses. If significant differences are found in a sample of teachers whose range of influence patterns was slightly smaller than expected, the conclusions of the project are strengthened.

Later in the second year we had time to administer a second, longer form of the M.S.A.I. to the 32 classes. The results will be discussed later on in this report.

The Control of Teacher Influence in the Second Year Study

Some situations that occur naturally in the field may not permit an appropriate test of a given hypothesis. The problem is to locate situations in which the conditions for testing hypotheses are suitable. For example, an hypotheses that predicts the results of direct influence can be tested only in a classroom in which the teacher is above average in direct influence. The strategy is first, to have adequate measures of the independent variables; second, to classify situations according to the conditions required to test hypotheses; and third, to tabulate all measures of dependent variables within situations that are homogeneous in order to make statistical comparisons.

Observer reliability:--In order to achieve control of teacher influence under field conditions, it is necessary to have a team of reliable observers.

Three observers performed most of the observation during the second year. Two additional observers acted as substitutes when necessary. Two of the three regular observers received their initial training during the first year of this two year project and were experienced observers with a known degree of reliability at the beginning of the second year.

Training of both old and new observers took place prior to the teaching of the first unit of study. During the first part of this training the new members of the team achieved Scott reliability ratings which ranged from 0.64 to 0.76. With additional training these ratings improved until the between-observer Scott reliabilities were consistently above 0.85.

Throughout the data collecting period the observers met together about once a week. At these meetings any unusual classification problems were discussed and a policy established so that if other observers faced the same problems later on they could react consistently.

In May of the second year, the two substitute observers and one of the regular observers had the opportunity to check their reliability approximately two months after the last regularly scheduled observation. Although this was in connection with another study, it presented the opportunity of checking on reliability after a period of inactivity. The three Scott indexes were 0.87, 0.90 and 0.94.

The reliability of the observers was sufficiently high to keep errors of interaction analysis small in comparison with the differences between the teacher groups that are compared later in this report.

Observer bias is not likely to influence the results when reliability is as high as that achieved in the project. However, another simple test can be made to show that even if the observers were biased, they were assigned to classes in such a way as to eliminate the effects of bias. This test asks the question, did any single observer contribute to the classification of teachers according to their influence patterns?

Table Thirteen indicates the total number of visits made to each type of teacher for each observer. A single visit in mathematics lasted about one hour, a single visit to social studies classes lasted about two hours. A Chi-square test was made separately for mathematics and social studies to test the hypothesis that the assignment of observers to different types of teachers could have occurred by chance. The null hypothesis is accepted since the two Chi-square calculations of 1.99 and 2.53 are low when compared with 7.82 required to reject the hypothesis at the 0.05 level of confidence at three degrees of freedom. (Note: the fifth observer or second substitute visited only one class and was ignored in the foregoing analysis.)

Table Thirteen

VISITS TO DIRECT AND INDIRECT CLASSES BY OBSERVERS

Observer	Mathematics Indirect	Mathematics Direct	Social Studies Indirect	Social Studies Direct
	n = 7*	n = 9*	n = 7*	n = 8*
A	21	20	14	15
B	8	12	12	12
C	10	17	9	8
D	1	3	1	5
Total	40	52	36	40

Math: Chi-square = 1.99 at 3 d.f.
Social Studies: Chi-square = 2.53 at 3 d.f.

*The total number of teachers in each classification is explained in the next section of this chapter.

The case for adequate observer reliability rests on measures of reliability and the possible bias that could have occurred through assignment. Reliability checks after training indicated Scott indexes above 0.85 and group discussions were held regularly to discuss unusual problems of classification. The evidence indicates that the observers could make the distinctions necessary to differentiate between patterns of teacher influence.

In terms of bias from the assignment of an observer, it has been shown that even if observers were significantly different from each other and tended to bias their observations toward direct or indirect patterns, this could not have influenced the classification of teachers into the direct and indirect groups.

Classifying teachers by I/D ratio alone:--A quick way of identifying teachers whose influence patterns are alike, is to calculate the ratio of their use of indirect and direct influence. This is commonly referred to as an "I/D ratio."

There are two ways to calculate an I/D ratio. One way is to use all tallies in categories one through four in the numerator and categories five through seven in the denominator. The second way is the same

2

as the first except that categories four and five are not used. We prefer the latter system because it is more independent of the subject matter being taught. In the teaching of mathematics, for example, there is a higher loading in category four probably because the content lends itself to teacher question and student answer type discourse. It is our belief that the exclusion of categories four and five makes the I/D ratio more sensitive to those aspects of the teacher's influence that determine student attitudes.

The sixteen teachers in mathematics and the sixteen teachers in social studies can be listed in a simple rank order based on I/D ratios. Table Fourteen shows this list for social studies and mathematics.

Table Fourteen

CLASSIFICATION OF TEACHERS BY I/D RATIO

ASSIGNMENT	Social Studies Code Number	Social Studies Ratio	Mathematics Code Number	Mathematics Ratio
INDIRECT	R 701	3.26	D 804	5.17
	P 703	2.43	C 801	3.86
	C 704	2.16	I 801	2.81
	L 706	1.74	P 805	2.65
	H 704	1.29	A 803	2.36
	P 701	1.02	M 805	1.41
	(N 702)*	(1.01)	V 803	1.37
	M 701	0.70		
DIRECT	R 702	0.63	M 802	0.51
	F 701	0.60	G 801	0.47
	D 706	0.42	V 804	0.36
	Q 701	0.30	H 802	0.34
	A 701	0.23	L 803	0.28
	D 708	0.12	T 802	0.26
	G 703	0.12	E 802	0.16
	B 704	0.07	G 802	0.11
			A 802	0.10

*N 702 was dropped from the study.

In mathematics a fairly large numerical break occurs between the seventh and eighth teachers in rank order. Therefore, teachers whose I/D ratios were 1.37 or higher were arbitrarily assigned to the indirect classification.

The list in social studies shows no such natural break. We therefore arbitrarily assigned the dividing line between indirect and direct teachers one-half way down the list, between the eighth and ninth ranking teachers. Later on in our analysis we discovered that the class taught by teacher N 702 was an abnormal class. It contained six sight-saving students whose visual disability was so great that they had to have all of our tests read by some other person. In addition, five students were assigned to this class because of emotional difficulties. For these reasons the class was dropped from the study. The dividing line was kept at the same position so that in social studies seven teachers were classified as indirect and eight as direct.

Having classified the mathematics and social studies teachers into four main groups, we are now ready to inquire into the differences between the direct and indirect teachers.

The most complete description of a teacher's pattern of influence goes beyond a simple I/D ratio and requires a 10 X 10 matrix. The observation tallies of a group of teachers can be combined into a single matrix[1] representing the influence pattern of the total group. The four raw score matrices for the direct and indirect mathematics and social studies teachers can be found in Appendix C, pp. 6-9. Tables Fifteen, Sixteen, Seventeen, and Eighteen show the same raw data converted so that the numbers in each cell indicate the incidence per 1,000 tallies. Once converted to a common denominator, cell frequencies are directly comparable.

The four original matrices were tested to see if they were significantly different by a Darwin Chi-square test. The Chi-squares calculated were converted to "z" scores. The results of the tests are as follows. For social studies, indirect N = 7 versus direct N = 8, Darwin Chi-square = 1,933.1, which is a difference well beyond the 0.01 level of confidence at 90 d.f. For mathematics, indirect N = 7 versus direct N = 9, Darwin Chi-square = 2,383.8, which is even less likely to occur by chance. We conclude from these tests that the influence patterns of the groups being contrasted are significantly different. We can now proceed to analyze the particular differences in the matrices.

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[1] A statistical procedure for testing the homogeneity of several matrices has been suggested. Its practical application has not yet been worked out at the time this report is written.

Table Fifteen

INTERACTION MATRIX FOR INDIRECT MATHEMATICS TEACHERS, N = 7
ADJUSTED FOR 1,000 TALLIES

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	0.1	--	0.1	0.3	1.1	--	--	--	0.1	0.3	2.3
2	--	1.6	2.7	2.8	5.4	0.5	0.2	0.1	1.3	2.3	16.9
3	0.2	2.6	29.3	15.8	20.6	0.8	0.3	2.5	5.0	3.9	81.1
4	0.3	0.5	0.7	27.7	6.7	1.7	0.3	74.1	4.6	8.5	125.2
5	0.8	1.3	2.1	47.0	383.9	8.8	1.7	0.9	12.0	8.6	467.2
6	--	--	0.2	1.8	5.3	9.7	0.3	6.1	1.9	8.5	33.8
7	--	0.1	0.1	1.2	1.6	0.6	2.5	0.5	0.6	2.3	9.4
8	0.3	7.3	29.0	17.9	23.0	3.5	1.1	20.3	3.0	1.9	107.3
9	0.3	2.9	16.1	3.6	8.4	1.8	0.9	0.1	25.0	2.1	61.2
10	0.2	0.5	0.6	7.2	11.1	6.3	2.2	2.6	7.9	7.8	95.6
TOTAL											

per 1,000 tallies
n = 26,083

Table Sixteen

INTERACTION MATRIX FOR DIRECT MATHEMATICS TEACHERS, N = 9
ADJUSTED FOR 1,000 TALLIES

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	0.1	--	--	0.1	0.4	0.1	0.1	--	0.2	0.2	1.1
2	0.1	0.9	0.8	1.7	2.7	1.1	0.1	0.2	0.9	2.2	10.6
3	0.1	0.5	5.3	4.7	8.2	--	1.2	0.4	1.0	2.8	26.3
4	0.1	0.3	0.1	6.8	3.4	2.6	0.8	67.7	5.7	7.8	95.3
5	0.4	1.3	0.7	34.4	312.9	18.1	7.2	2.8	15.9	14.6	408.3
6	--	0.2	--	4.6	9.6	27.7	3.4	17.8	6.2	17.1	86.4
7	--	0.2	0.1	3.4	7.5	4.0	18.8	1.2	3.2	8.1	46.6
8	--	4.2	10.7	25.0	30.3	11.6	4.2	36.0	3.5	4.6	130.2
9	0.2	1.8	8.1	5.7	20.5	7.1	3.9	0.4	14.9	4.8	67.4
10	0.1	1.3	0.4	9.0	12.9	13.0	7.6	3.1	14.2	66.4	127.9
TOTAL											

per 1,000 tallies
N = 32,726

Table Seventeen

INTERACTION MATRIX FOR INDIRECT SOCIAL STUDIES TEACHERS, N = 7
ADJUSTED FOR 1,000 TALLIES

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	0.3	0.3	0.1	0.1	0.1	0.1	0.1	1.1
2	0.1	1.1	2.6	2.9	2.4	0.5	0.1	0.4	1.2	1.0	12.5
3	--	1.4	25.3	17.8	18.6	1.7	0.4	3.6	7.5	6.4	82.8
4	0.2	0.3	0.8	21.9	5.9	1.7	0.7	57.8	12.0	6.2	107.5
5	0.4	1.0	1.3	28.1	310.6	7.2	2.6	1.6	11.3	10.2	374.5
6	0.1	0.1	0.1	3.3	5.6	16.0	1.5	4.0	2.2	10.1	42.9
7	0.1	0.1	0.1	1.7	3.0	1.2	6.8	0.4	0.6	3.0	16.9
8	--	4.9	25.6	17.8	10.7	3.2	1.0	104.0	4.3	3.8	175.4
9	0.1	3.3	26.0	6.4	7.6	1.9	1.1	0.3	44.3	3.9	94.8
10	0.2	0.3	0.8	7.4	9.6	9.4	2.6	3.2	11.1	47.0	91.6
TOTAL											

per 1,000 tallies
N = 28,194

Table Eighteen

INTERACTION MATRIX FOR DIRECT SOCIAL STUDIES TEACHERS, N = 8
ADJUSTED FOR 1,000 TALLIES

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	0.2	--	--	--	--	0.1	--	0.3
2	--	0.5	0.9	2.8	3.2	1.4	0.3	0.5	0.7	1.1	11.4
3	--	0.7	4.1	6.8	8.9	1.1	0.7	1.9	3.3	2.8	30.3
4	0.1	0.2	0.5	20.8	3.3	3.3	1.8	62.3	7.9	7.8	108.0
5	--	1.1	0.8	29.6	170.4	15.7	4.9	5.0	13.2	16.0	256.7
6	0.1	0.3	0.2	5.8	8.8	37.6	4.1	11.5	7.4	22.8	98.6
7	--	0.4	0.1	6.0	5.1	4.4	24.1	1.9	3.2	8.0	53.2
8	--	5.7	12.9	19.5	25.6	8.0	4.7	127.3	5.0	6.0	214.7
9	--	1.8	10.2	5.1	16.7	8.3	3.4	0.4	35.3	5.8	87.0
10	0.1	0.9	0.5	11.5	14.8	18.7	9.2	3.8	10.7	69.1	139.4
TOTAL											

per 1,000 tallies
N = 23,641

The first comparisons one can make between two contrasting matrices concerns the question, what is the relative time spent in each category? The answer to this question can be found by comparing the column totals of the matrix. Figures Three and Four show these comparisons in histogram form.

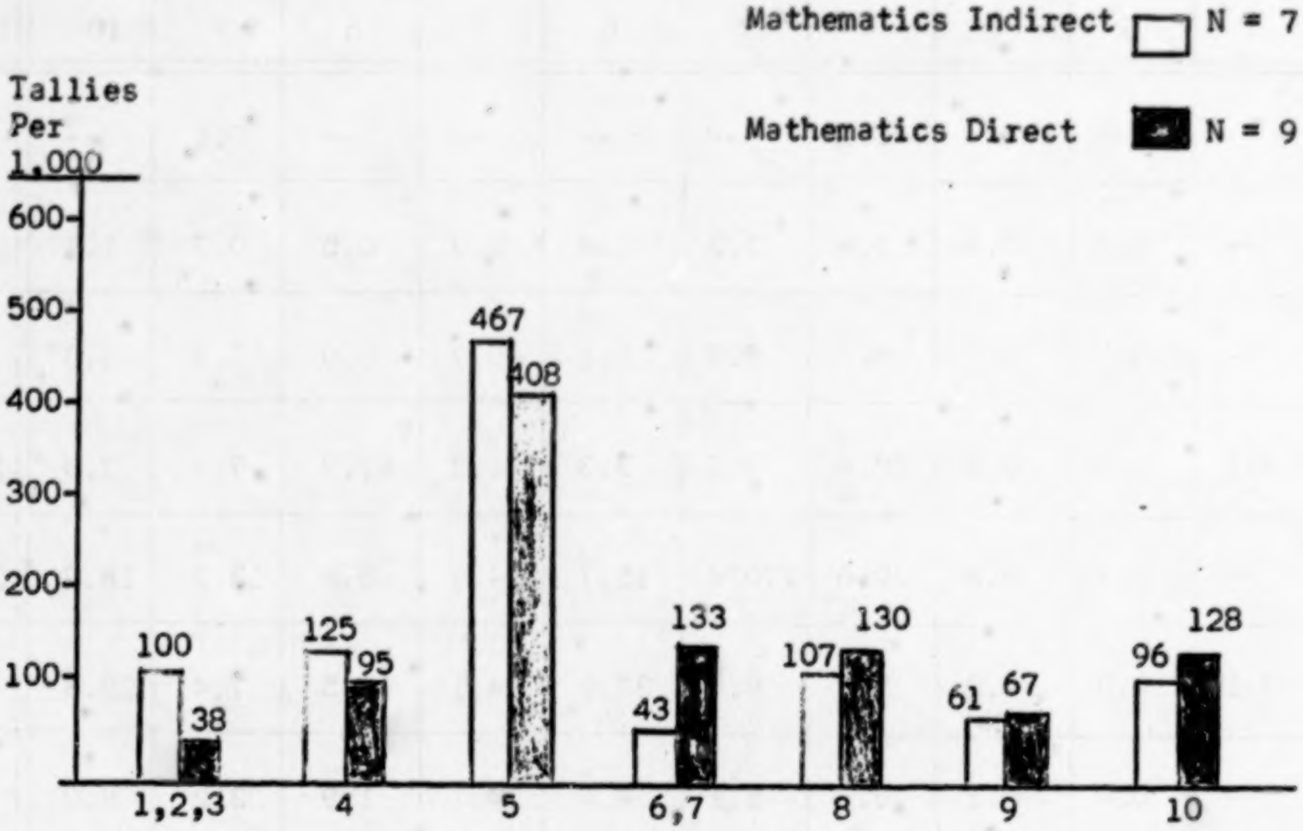

Fig. 3
Influence Patterns of Direct and Indirect
Mathematics Teachers

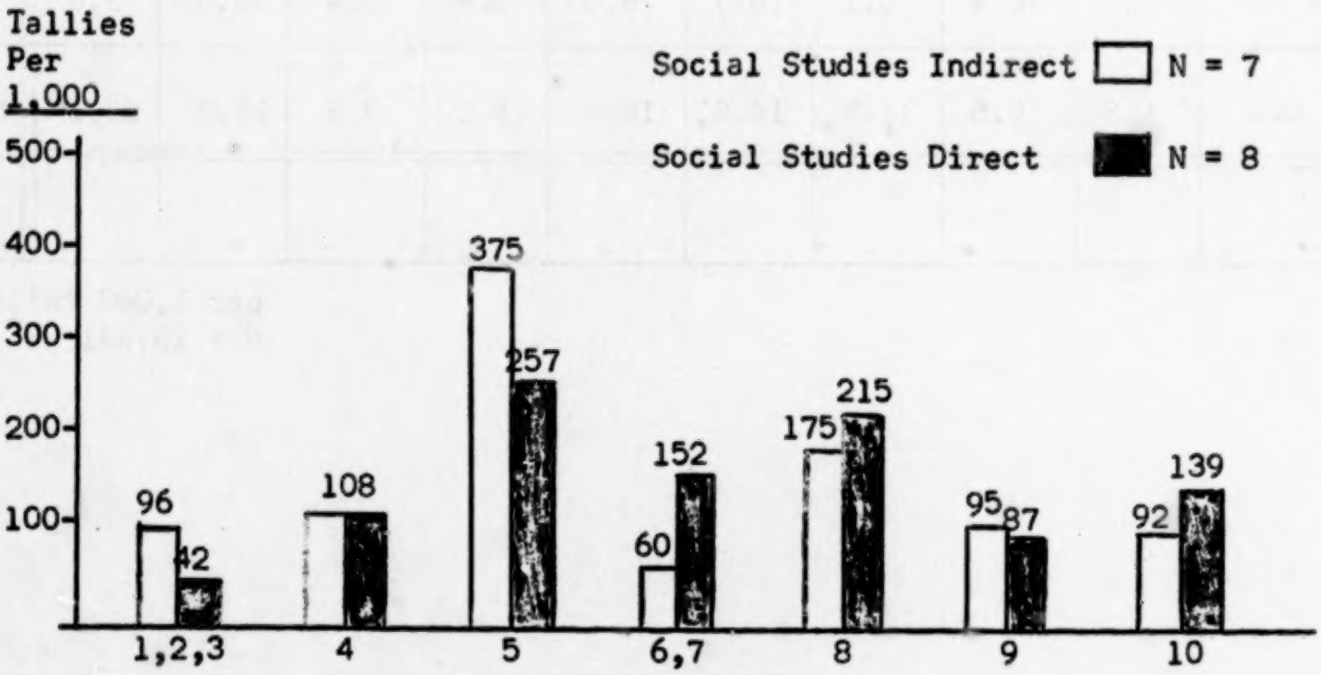

Fig. 4
Influence Patterns of Direct and Indirect
Social Studies Teachers

Due to selection by I/D ratio, the higher number of tallies in categories 1, 2, and 3 and the lower number of tallies in 6 and 7 for the indirect teachers can be clearly seen on the two graphs. In addition, the indirect teachers lecture more, the students talk slightly less, and less time occurs as silence or confusion. The distribution of time spent in teacher talk, student talk and silence is shown in Table Nineteen.

Table Nineteen

PER CENT TEACHER TALK, STUDENT TALK AND SILENCE FOR DIRECT AND INDIRECT TEACHERS

	Mathematics		Social Studies	
Condition	Indirect	Direct	Indirect	Direct
Teacher Talk	74.6	67.4	63.8	55.9
Student Talk	16.8	19.8	27.0	30.2
Silence	9.6	12.8	9.2	13.9

Given the matrices in Tables Fifteen, Sixteen, Seventeen and Eighteen, as well as Figures Three and Four, we are now in a position to interpret[1] the differences between the indirect and direct teachers.

A first interpretation is that the indirect teachers not only clarify, develop, and make more frequent use of student ideas; they also persist in this activity for a longer period once they start. The column totals of category three, in both the mathematics and social studies matrices, show that indirect teachers make use of this category about three times as frequently as do the direct. Indirect teachers not only make use of the category more frequently, but the process of clarifying and using student ideas lasts longer once it is initiated. The evidence for this last statement is found in the 3-3 cells. The ratio between indirect and direct teachers for this one cell is six to one in social studies and 5.5 to one in mathematics. These data show that a more extensive development of student ideas is made by the teacher in the indirect classrooms. In the direct classroom, similar teacher statements are more perfunctory, short acknowledgments.

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[1] The serious reader may wish to read (or review) the section on matrix interpretation on pp. 15-24 of Appendix F.

A second interpretation, made for mathematics teachers only, is that the indirect teachers use questions differently from the direct teachers. In mathematics, the indirect teachers ask more questions by a ratio of four to three. The frequencies in the 4-4 cells of the mathematics matrices indicate that the indirect teachers are likely to ask longer questions four times as often. These data indicate that the indirect teachers use longer, more extended questions. The questions of direct teachers are more often short and elicit short responses. No differences of this type were found among social studies teachers.

The third interpretation concerns giving directions, category six, and criticizing students, category seven. Two cells, 6-7 and 7-6 indicate sequences that are particularly sensitive to discipline problems. A teacher who must interrupt the giving of directions to criticize and then shifts back to further directions is not receiving the compliance he expects. Tallies in these two cells occur three times as frequently in direct classrooms.

Sustained criticism or lengthy justification of the teacher's use of authority is recorded in the 7-7 cell. These frequencies are 3.5 times higher in the direct classrooms. Twice as many lengthy directions also occur in the 6-6 cells. The higher frequencies in cell 6-9 for the direct teachers is consistent with the patterns in categories six and seven; it indicates that students initiate ideas of their own when compliance is normally expected.

These three interpretations suggest two differences between direct and indirect teachers. First, the indirect teachers are more attentive to what the students say and make greater use of student ideas. Second, direct teachers give more directions and students resist these directions more often. These differences are consistent with previous research.

Some patterns shown in the matrices and Figures Three and Four are inconsistent with previous research and were not expected. The higher per cent of total teacher talk for indirect teachers, shown in Table

Nineteen was not expected. Usually indirect teachers lecture less than direct teachers, but category five shows the opposite trend. These and other inconsistencies suggest that the simple two-way split of the I/D rank order to form indirect and direct groups combined teachers who have different patterns of influence. The next sections will describe further divisions of the experimental teachers in an attempt to form more homogeneous groups.

The procedures used in the further classification of teachers:-- The division of the fifteen social studies and sixteen mathematics teachers into smaller groups is limited, in this project, by the number of students in each class. For our purposes, each group of teachers must contain enough students so that the differential effects of direct and indirect teaching patterns can be tested separately for above average, average, and below average students.

The loss of students in the field study ranged from two to as high as twelve students per class. Losses were due primarily to being absent on the day of the pre-test or post-test, but more extended absences during the two week unit due to sickness, etc., accounted for additional losses.

Four classes appears to be about as small a group as is possible in this research design. In such a group there would be about 80 to 100 students. The top and bottom 25 per cent in ability provides 20 to 25 students for subsequent analysis, which is little enough.

These considerations pose particularly difficult problems in dividing the 15 social studies teachers. In a moment it will be shown that when interaction data is the only factor determing the grouping, there are four identifiable groups: first, three "most indirect" teachers; second, three "indirect content oriented" teachers; third, five "average" teachers; and fourth, four "most direct" teachers. In the end, the practical problems of analysis forced us to combine the first two groups so that the "most indirect" contains six teachers, the "average" five, and the "most direct" four.

The mathematics teachers were more easily divided into similar groups. Six were assigned to the "most indirect," five to "average" and five to the "most direct."

The procedure for selecting teachers was the same for social studies and mathematics. First, comparisons were made of the total frequency in each category which is shown as Areas A, B and C, in Figure Five. The graphs of Figures Three and Four illustrate how the column totals which comprise areas A, B, and C, can be grouped for interpretation.

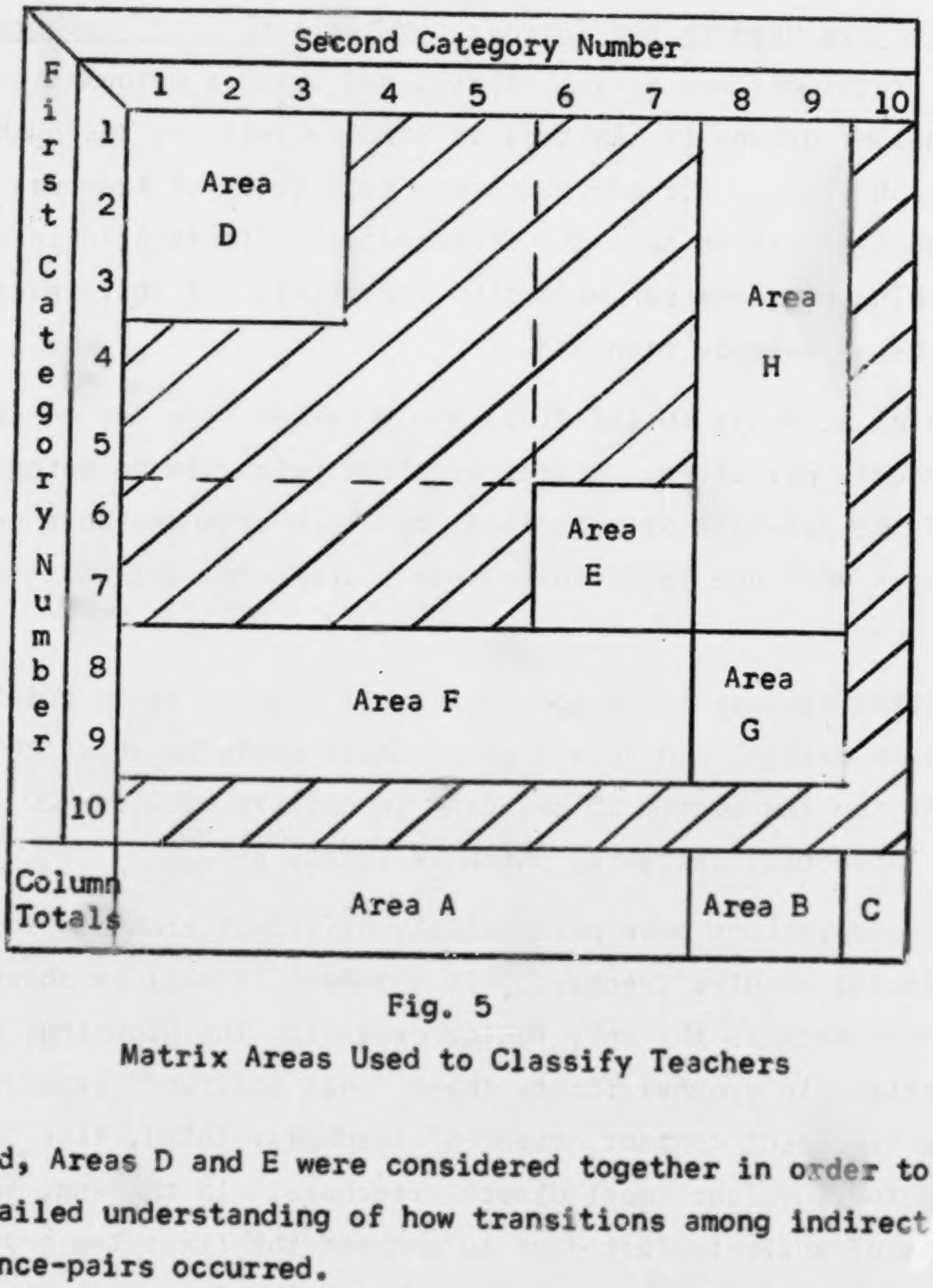

Second Category Number
1 2 3 4 5 6 7 8 9 10
First Category Number
1 2 3 4 5 6 7 8 9 10
Area D
Area H
Area E
Area F
Area G
Column Totals
Area A
Area B
C

Fig. 5
Matrix Areas Used to Classify Teachers

Second, Areas D and E were considered together in order to obtain a more detailed understanding of how transitions among indirect and direct sequence-pairs occurred.

Third, Areas F, G and H were studied in order to determine, (a) how the teacher reacts when students stop talking--area F; (b) what stimulates students to talk--area H; and (c) to what extent sustained student communication occurs--area G.

The basic data to which this procedure was applied were the individual master matrices for each teacher. These matrices can be found in Appendix C, pp. 10-40. All matrices shown in the body of the report have been converted to the column total of 1,000 tallies. Single cell frequencies thus become directly comparable.

The further classification of social studies teachers:--Three teachers, R 701, C 704, and H 704, who were classified as indirect by I/D rank order, have a particularly high total of frequencies in category five. This indicates that the higher than expected lecturing found among indirect social studies teachers is due primarily to these three. Three other teachers, L 706, M 701 and P 703, have fewer category five statements and more student talk, shown in categories eight and nine. In spite of these differences in style, all six teachers share above average I/D ratios.

The seventh teacher listed as indirect in the preceding section, P 701, is the least indirect of the six. This teacher has a low 3-3 cell frequency and more tallies in the 6-7 and 7-6 cells than the others. P 701 was, therefore, shifted from the most indirect classification to the average.

Tables Twenty and Twenty-one respectively show the combined matrices of the three indirect teachers who are "most indirect" and the three who are indirect with an above average per cent of lecturing. The first three ask more questions and stimulate more student talk. They use twice as much praise, give more directions, but use less criticism.

Besides the differences noted, there are a number of similarities between these two groups. The teacher's response when students stop talking and the conditions that stimulate student participation are quite similar. In both groups sustained student talk occurs. The essential difference is in the amount and style of lecturing. The content oriented teachers talk longer without interruption once they start to lecture.

For the reasons indicated in the previous section, these two groups were combined to form a group of six teachers called the "most indirect." It is unfortunate that this combination was necessary. Table Twenty-Two shows the combined matrix of the six teachers. It will not be interpreted since it combines the characteristics of the two sub-groups just described.

Table Twenty

INTERACTION MATRIX FOR MOST INDIRECT SOCIAL STUDIES TEACHERS, N = 3 ADJUSTED FOR 1,000 TALLIES

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	0.6	0.2	0.2	0.1	--	0.2	0.1	1.4
2	0.2	1.1	3.7	5.2	2.5	1.0	--	0.9	1.5	0.7	16.9
3	0.1	1.9	26.3	22.8	17.1	1.7	0.2	3.3	4.8	3.5	81.6
4	0.2	0.6	1.1	38.5	7.2	1.8	0.6	73.6	11.7	8.9	144.3
5	0.2	0.8	1.2	30.9	203.9	9.9	1.4	3.1	7.4	9.4	268.3
6	0.2	0.2	0.1	4.3	6.2	23.3	1.0	5.4	2.1	13.7	56.4
7	0.1	0.1	0.1	1.5	1.6	0.8	2.8	0.4	0.2	1.6	9.2
8	--	8.3	33.2	24.3	12.1	3.3	0.8	139.9	5.6	4.3	231.8
9	0.2	3.7	15.2	6.4	7.8	2.6	0.5	0.2	46.0	2.5	85.2
10	0.3	0.2	0.8	9.8	9.5	11.8	1.8	4.9	5.6	60.0	104.8
TOTAL											

per 1,000 tallies
N = 11,727

INTERACTION MATRIX FOR CONTENT CENTERED SOCIAL STUDIES TEACHERS, N=3
ADJUSTED FOR 1,000 TALLIES

Table Twenty-One

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	0.4	--	0.1	0.1	--	0.1	0.7
2	--	0.9	1.8	0.9	2.5	--	0.1	0.2	0.9	1.0	8.4
3	--	0.9	27.8	11.0	20.3	1.7	0.5	4.3	9.9	8.5	84.8
4	0.1	0.1	0.2	13.5	4.4	1.0	0.4	36.5	11.5	3.0	70.7
5	0.6	1.1	1.6	25.5	440.3	5.1	3.2	0.3	14.7	9.7	502.2
6	--	0.1	0.1	1.7	5.5	10.4	1.1	1.7	1.6	6.4	28.6
7	--	0.1	0.1	1.4	3.6	1.0	9.6	0.4	0.4	2.9	19.5
8	--	2.3	16.9	9.1	8.7	1.7	0.7	63.0	3.0	2.8	108.1
9	--	2.6	35.5	3.8	6.9	0.9	0.9	0.4	45.9	4.1	101.2
10	0.1	0.3	0.9	3.7	9.6	6.7	2.7	1.3	13.1	37.4	75.8
TOTAL											

per 1,000 tallies
N = 13,593

Table Twenty-Two

INTERACTION MATRIX FOR MOST INDIRECT SOCIAL STUDIES TEACHERS, N = 6
ADJUSTED FOR 1,000 TALLIES

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	0.3	0.3	0.1	0.1	0.1	0.1	0.1	1.1
2	0.1	1.0	2.7	2.9	2.5	0.5	0.1	0.6	1.2	0.8	12.3
3	--	1.3	27.1	16.4	18.8	1.7	0.4	3.8	7.5	6.2	83.3
4	0.2	0.3	0.6	25.0	5.7	1.3	0.5	53.7	11.6	5.8	104.8
5	0.4	1.0	1.4	28.0	330.8	7.3	2.4	1.6	11.3	9.6	393.8
6	0.1	0.1	0.1	2.9	5.8	16.4	1.1	3.4	1.8	9.9	41.5
7	--	0.1	0.1	1.5	2.7	1.0	6.5	0.4	0.3	2.3	14.7
8	--	5.1	24.4	16.2	10.3	2.4	0.7	98.6	4.2	3.5	165.4
9	0.1	3.2	26.1	5.0	7.3	1.7	0.8	0.3	45.9	3.4	93.8
10	0.2	0.2	0.8	6.6	9.5	9.1	2.3	3.0	9.6	47.9	89.2
TOTAL											

per 1,000 tallies
N = 25,320

The next group to be identified was the most direct group consisting of D 706, G 703, B 704 and Q 701. The combined matrix of this group is shown in Table Twenty-three. The I/D ratio of this matrix is 0.194.

The cause of this low I/D ratio appears to be excessively high direct influence rather than lack of indirect influence. These four teachers give many more directions and criticize or justify their own authority much more than the most indirect teachers. They clarify and make use of student ideas one-fourth as often as the most indirect. Interestingly enough, the most direct teachers give more praise than any other group. This occurs primarily at the termination of student response statements. On the other hand, indirect teachers give more praise than direct teachers at the termination of student initiated statements.

The cell frequencies in Area D (see Fig. 5, p. 60) are very low and the 3-3 cell indicates that only one out of 14 attempts to clarify and develop the ideas of a student extends over a three second period. The chances of the teacher shifting from clarifying a student's idea to asking a question are half as great in the most direct classrooms compared with the most indirect. The orientation of the most direct teachers to the students' ideas is very low.

An inspection of Area E (see Fig. 5) indicates about four times as many directions and criticisms for the most direct teachers compared with the most indirect. This means the most direct teachers are much more likely to shift from giving directions to criticism, to extend this criticism in order to make it emphatic, and then return to giving more directions.

Areas F, G, and H (see Fig. 5) indicate that the most direct teachers do become somewhat more indirect when responding to students, but not as much as the most indirect teachers. For example, the most direct teachers' total matrix I/D is 0.194 which changes to 0.801 when only responses made at the termination of student talk are taken into consideration. The similar shift for the most indirect is from 1.72 to 10.5. The incidence of student talk lasting more than three seconds is much lower. Students are more likely to talk when directions or criticism is given by the teacher.

Table Twenty-Three

INTERACTION MATRIX FOR MOST DIRECT SOCIAL STUDIES TEACHERS, N = 4 ADJUSTED FOR 1,000 TALLIES

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	0.1	--	0.1	--	--	--	--	0.2
2	--	1.1	1.2	3.2	4.6	2.5	0.5	0.5	1.3	1.7	16.6
3	--	0.6	1.5	6.2	8.6	0.7	0.8	0.5	1.4	1.3	21.7
4	--	0.2	0.7	8.4	2.3	2.4	2.4	53.9	7.8	5.2	83.4
5	--	2.1	0.8	25.3	188.7	16.8	7.8	4.3	18.2	21.7	285.7
6	0.1	0.5	--	5.7	10.3	43.4	6.3	11.9	10.7	22.2	111.2
7	--	0.7	--	8.3	7.9	6.5	40.6	3.6	5.8	13.7	87.2
8	--	6.6	10.4	12.3	21.5	8.2	6.3	64.5	4.8	7.4	142.3
9	--	3.0	6.6	4.4	23.4	12.4	6.3	0.6	21.6	7.8	86.2
10	0.1	1.7	0.4	9.3	18.3	18.3	16.2	2.3	14.6	84.5	165.7
TOTAL											

per 1,000 tallies
N = 9,963

All social studies teachers who did not fit into either of the two groups just described were assigned to the average group. The teachers in this group are A 701, D 708, F 701, P 701, and R 702. The matrix of their interaction is shown in Table Twenty-four. In most respects, the distribution of teacher and student statements is midway between the most indirect and the most direct groups just described. There are three exceptions to the midposition of the average group. This group praised students the least, lectured the least, and the students talked the most. These comparisons are illustrated in Figure 6.

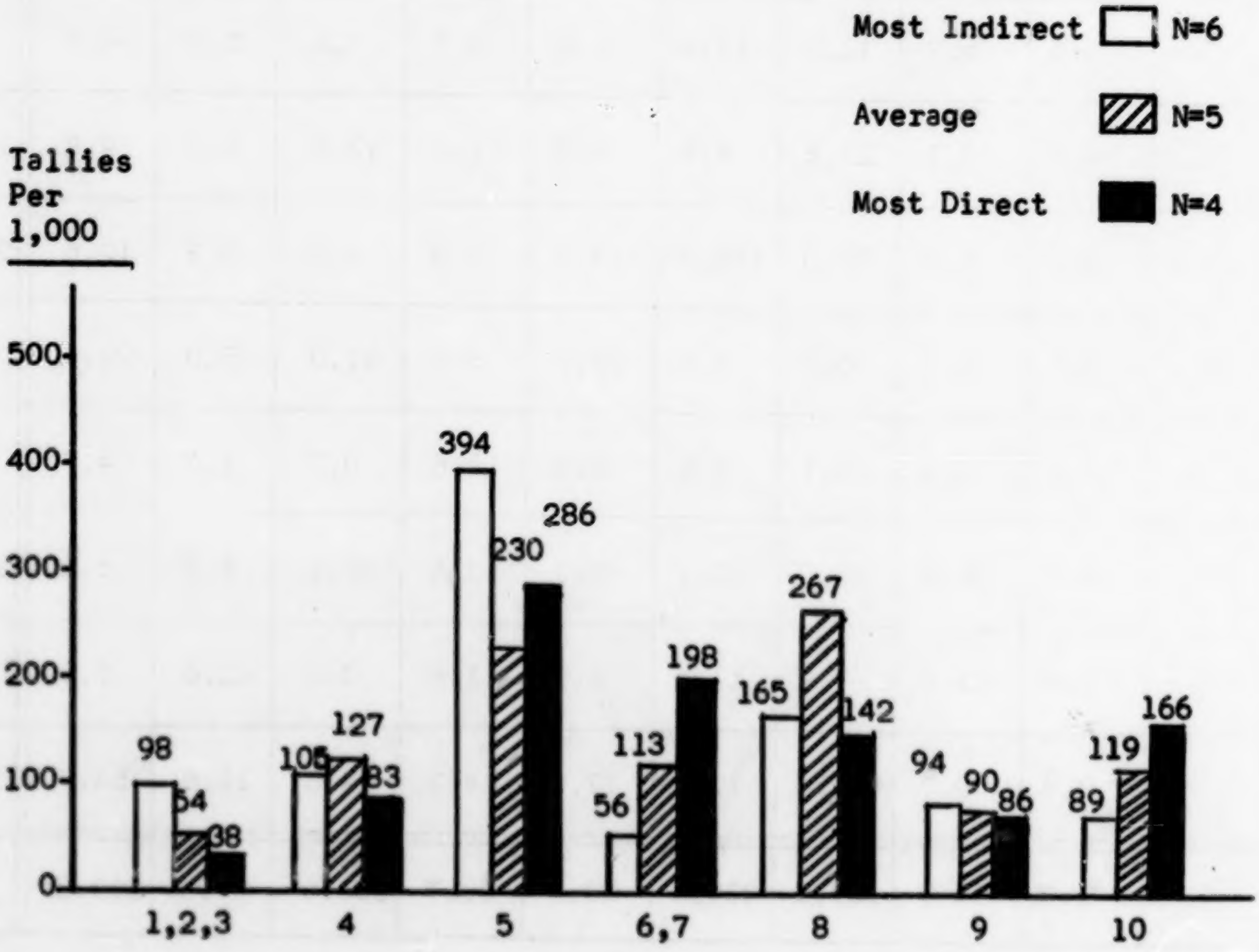


Fig. 6
Influence Patterns of Most Indirect, Average and Most Direct Social Studies Teachers

Table Twenty-Four

INTERACTION MATRIX FOR AVERAGE SOCIAL STUDIES TEACHERS, N = 5

ADJUSTED FOR 1,000 TALLIES

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	0.2	0.1	--	--	--	0.2	--	0.7
2	--	0.5	1.0	2.7	2.1	0.6	0.2	0.4	0.5	1.0	9.0
3	--	0.9	6.7	11.1	10.4	1.5	0.7	2.6	5.2	4.7	43.9
4	0.2	0.3	0.7	23.6	4.6	4.2	1.4	73.0	9.2	9.8	127.0
5	0.1	0.5	0.8	32.0	153.0	13.3	3.0	4.9	9.9	12.6	230.0
6	0.1	0.1	0.3	6.0	6.9	29.8	3.0	11.0	5.0	21.4	83.7
7	--	0.1	0.2	4.1	3.5	3.0	11.6	0.7	1.7	4.7	29.7
8	--	4.7	18.4	26.0	26.2	8.2	3.6	169.2	5.2	5.2	266.6
9	--	1.4	15.0	7.9	11.4	5.0	1.8	0.2	42.6	5.0	90.4
10	--	0.4	0.7	13.4	12.0	17.9	4.3	4.8	10.8	54.7	119.0
TOTAL	0.7	9.0	43.9	127.0	230.0	83.7	29.7	266.6	90.4	119.0	1,000

per 1,000 tallies
N = 16,552

The further classification of mathematics teachers:--The procedure of classifying the sixteen mathematics teachers was identical to the social studies procedure just described. In mathematics the most indirect group consisted of D 804, C 801, P 805, A 803, I 801, and V 803. The average group consisted of M 805, M 802, V 804, H 802, and E 802. The most direct group consisted of A 802, G 802, T 802, G 801, and L 803. The combined matrices for these three groups are shown respectively in Tables Twenty-five, Twenty-six, and Twenty-seven.

The column totals of these three matrices indicate that many of the differences found between the social studies teachers also exist between the three groups of mathematics teachers. The comparisons can be made visually by referring to Fig. 7.

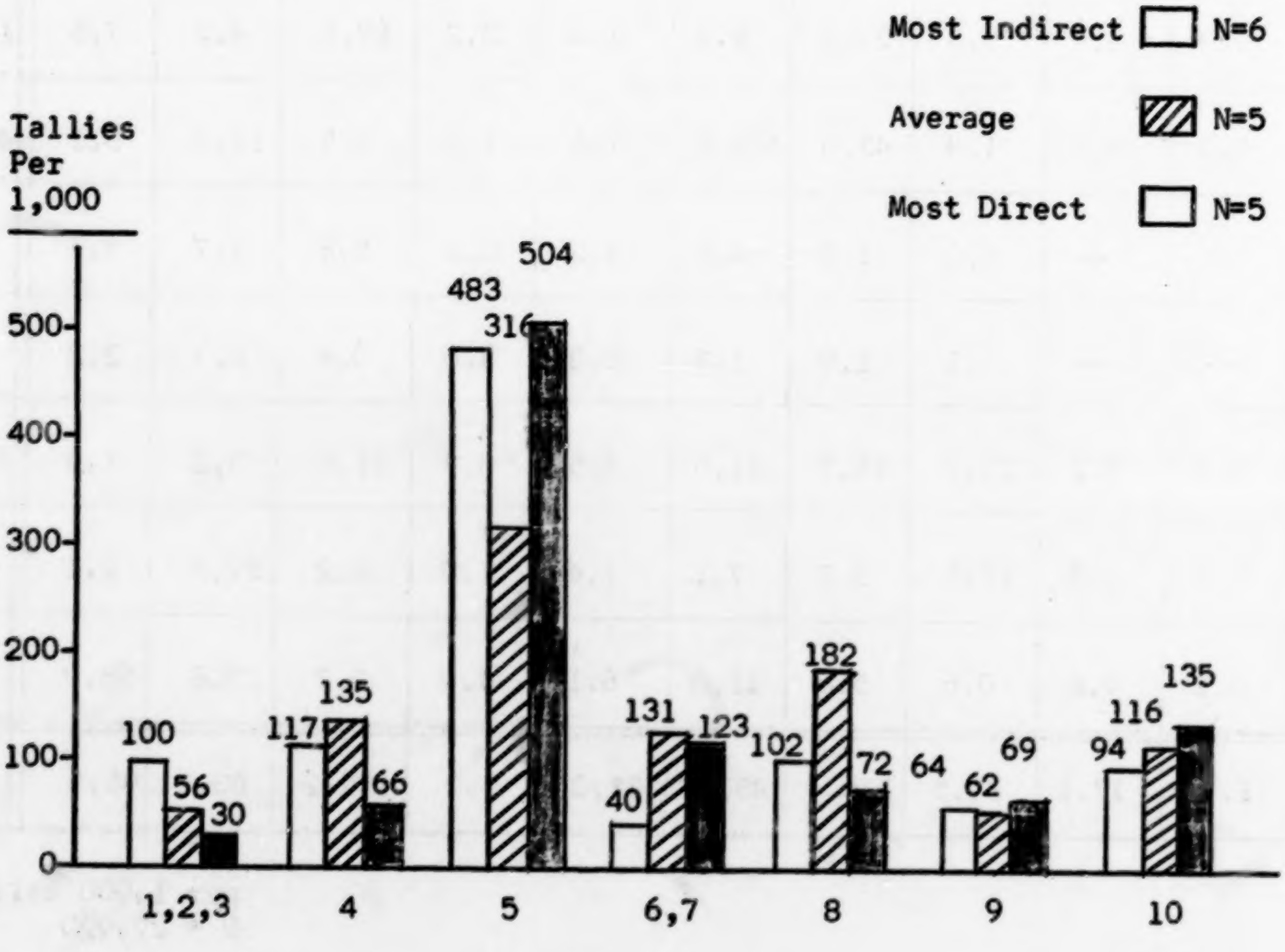


Fig. 7

Influence Patterns of Most Indirect, Average and Most Direct Mathematics Teachers

Table Twenty-five

INTERACTION MATRIX FOR INDIRECT MATHEMATICS TEACHERS, N=6
ADJUSTED FOR 1,000 TALLIES

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	0.1	--	0.1	0.3	1.0	--	--	--	0.1	0.3	1.9
2	--	1.8	2.4	2.7	5.3	0.5	0.2	0.1	1.4	2.7	17.1
3	0.2	2.6	31.4	14.4	18.8	0.7	0.3	2.6	5.3	4.2	80.5
4	0.3	0.4	0.8	27.1	6.4	1.4	0.2	68.1	4.2	7.5	116.4
5	0.7	1.2	1.9	43.5	405.8	7.6	1.5	0.9	12.0	8.1	483.2
6	--	--	0.2	1.5	4.8	9.2	0.1	5.8	1.7	7.7	31.0
7	--	--	0.1	1.0	1.3	0.3	3.0	0.4	0.7	2.2	9.0
8	0.3	7.2	25.2	16.7	21.9	3.5	0.7	21.6	3.2	1.9	102.2
9	0.3	3.3	17.8	3.3	7.1	1.4	1.0	0.2	27.2	2.1	63.7
10	0.2	0.6	0.6	5.8	11.0	6.1	1.9	2.7	7.8	58.3	95.0
TOTAL	1.9	17.1	80.5	116.4	483.2	31.0	9.0	102.2	63.7	95.0	1,000

per 1,000 tallies
N = 22,920

INTERACTION MATRIX FOR AVERAGE MATHEMATICS TEACHERS, N=5
ADJUSTED FOR 1,000 TALLIES
Table Twenty-Six

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	0.2	--	--	0.2	0.9	0.1	--	--	--	0.2	1.7
2	0.1	1.1	1.5	2.8	3.7	1.7	0.1	0.4	1.3	2.7	15.5
3	0.2	0.9	5.8	10.4	14.1	1.9	0.3	1.8	2.2	1.1	38.6
4	--	0.6	0.1	10.8	4.9	3.6	1.2	98.4	5.0	10.5	135.2
5	0.8	1.7	1.2	44.4	211.8	21.2	3.5	3.0	14.4	13.9	316.0
6	--	0.3	0.1	6.6	9.6	31.6	2.3	23.9	6.5	20.0	100.9
7	--	[illegible]	0.1	3.5	4.2	3.1	10.2	1.3	1.8	6.1	30.5
8	0.1	6.5	24.0	36.2	36.2	15.1	4.9	49.0	4.6	5.4	181.9
9	0.1	2.5	5.5	7.6	19.2	7.8	2.7	0.5	12.2	4.4	62.2
10	0.2	1.7	0.3	12.7	11.4	14.8	5.3	3.6	14.2	52.6	116.9
TOTAL	1.7	15.5	38.6	135.2	316.0	100.9	30.5	181.9	62.2	116.9	1,000

per 1000 tallies
N = 19,259

Table Twenty-Seven

INTERACTION MATRIX FOR MOST DIRECT MATHEMATICS TEACHERS, N=5
ADJUSTED FOR 1,000 TALLIES

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	0.1	--	--	0.1	0.1	0.1	--	0.2	0.1	0.8
2	--	0.4	0.7	0.5	2.1	0.3	0.1	0.1	0.4	1.1	5.8
3	--	0.4	6.4	2.1	6.2	0.5	0.5	0.2	3.4	3.3	23.0
4	0.1	0.1	0.1	6.8	2.8	1.6	0.4	41.6	7.0	6.0	66.4
5	0.4	0.9	0.7	30.1	413.0	14.0	10.6	2.2	16.8	15.1	503.6
6	0.1	--	--	2.0	9.4	20.4	4.3	8.8	5.2	13.2	63.3
7	--	0.2	0.2	3.1	10.5	4.8	26.1	1.0	4.3	9.6	59.8
8	--	2.4	4.0	12.3	23.4	5.9	3.4	16.1	1.7	3.2	72.4
9	0.2	0.8	10.4	3.4	21.6	5.8	4.6	0.2	16.8	5.0	68.9
10	--	0.5	0.5	6.1	14.5	9.9	9.7	2.2	13.1	78.8	78.8
TOTAL	0.8	5.8	23.0	66.4	503.6	63.3	59.8	72.4	68.9	135.4	1,000

per 1,000 tallies
N = 16,638

The evidence in Fig. 7 indicates that the most direct and the most indirect groups differ from each other in a manner that is very similar to the same two groups in social studies. The differences in social studies are greater, making the contrasts more dramatic.

The average group in mathematics takes the mid position in only three out of seven histograms. This lack of consistency is due to unusual combinations of teacher influence patterns and class activities within the same classroom as well as between classrooms. For example, a very direct teacher, E 802 (see Appendix C, p. 29) requires students to read new sections of the textbook out loud, one student at a time, which increases student talk to 35.7 per cent. Teacher M 802, (see Appendix C, p. 35) engages in an abnormally high amount of drill which can be identified by the high frequencies in cells 8-4 and 4-8. Almost one-half of all this teacher's questions and 82 per cent of responsive student talk can be accounted for in these cells. These teachers do not quite fit into the direct group because of higher student talk.

Returning to Tables Twenty-five, Twenty-six and Twenty-seven, the total tallies in Area D (see Fig. 5) for the most indirect, average, and most direct teachers respectively are 38.6, 9.8 and 8.0. The differences between the average and most direct are not significant; the large increase for the most indirect is due primarily to the 3-3 cell. These data show the greater orientation of the most indirect teachers to the encouragement and constructive use of student ideas.

In Area E (see Fig. 5), the total tallies in the same order are 12.6, 47.2 and 55.6 The ratio of occurrence of statements falling into the 6-7 and 7-6 cells, most direct compared with the most indirect, is 22.5 to one. These figures show the more active direct supervision, criticism of students, and use of the teacher's authority that can be found in the most direct classrooms. More direction is given by teachers and in turn, students resist the use of this authority more often.

A comparison of Area F (see Fig. 5) confirms earlier statements made about the average teachers. At the moment that a student stops talking, the average teacher is more likely to respond with a question than either of the other two types of teachers. This same type of teacher is also most likely to lecture and give directions and is approximately equal to the most direct teachers in the frequency of criticism. The distribution for the average teachers fits the picture of a teacher who has frequent, short verbal exchanges between the teacher and students similar to patterns of communication that occur in drill.

Summary of the classification of teachers:--The last four sections of this chapter have been concerned with the classification of teachers. The purpose of this classification is to group teachers in such a way that the major hypotheses about indirect and direct influence can be tested.

Five groups of teachers have been isolated. First, all teachers in mathematics and social studies were placed in a rank order based on their I/D ratios. The top half of this rank order has been called the indirect group, the bottom half the direct group.

Next, the same teachers were split into three groups by a procedure that took into consideration the entire interaction matrix of each teacher. The groups formed were called the most indirect, average, and the most direct. The best test of the hypotheses about direct and indirect teacher influence will occur by contrasting the most direct with the most indirect.

In order to be complete, the outcome variables of this study will be analyzed for all five groups in both mathematics and social studies.

Indirect teachers tend to have a stronger orientation to student behavior. The verbal participation of students tends to be slightly higher. Fewer directions and less criticism seem to be necessary. There are fewer pauses and silences during spontaneous interaction.

The direct teachers present the opposite trends.

The use of lecture is clearly different among teachers, but there are no consistent trends that appear in both mathematics and social studies. The indirect teachers show some evidence of greater flexibility in their influence patterns, but this concept will be dealt with in more detail as an outcome variable.

The Classification of Classroom Activities

In Chapter Two, pages 17, 18 and 19, the concept of teacher flexibility was operationally defined in terms of the question, does the teacher adapt his pattern of influence to the different types of classroom activities? Our observers were able to classify classroom episodes into 36 separate activities. It was decided to arrange the activities into four categories of planning, work, evaluation, and administration. Each observer presented his original notes about the activity period at a staff meeting of all observers, explained the conditions present at the time, and then proposed a classification of the episode into one of the four categories. After full discussion, the group decision was considered final.

Some of the activities were considered to have greater potential for student participation and expression of opinion. For example, a teacher can give an assignment that will have an unknown effect on subsequent student participation or expression of opinion, but the process of giving the assignment per se is likely to be restricting. Teacher-pupil planning of an assignment, on the other hand, involves a process that provides for student expression of opinion. It was decided to classify some of the planning and work activities according to whether they possessed greater potential for stimulating student participation and expression of opinion and to classify others that possessed less potential. The former were called "expanding" and labeled "E"; the latter were called "restricting" and labeled "R". Only the more obvious classifications were made. The entire list of the 36 activities, their classification into four major activity categories, and their assignment to the "E" or "R" category can be found on the next page.

These categories of classroom activities will permit the test of a number of related hypotheses concerning teacher influence. First, it will be possible to find out whether direct and indirect teachers differ in their ability to adapt their influence to different types of learning situations. These comparisons will clarify the relative flexibility of different teachers. Second, we can relate the organization of classroom activities and teacher influence during the initial, middle, and terminal phases of a two week unit of study. This last investigation can be made for classes who showed the largest gains in achievement contrasted with those which showed the least gain.

Categories for Classroom Activities

Evaluative
Category

A. PLANNING

R*. . . . . . .1. Long range planning, teacher assigns and describes work
E** . . . . . .2. Long range teacher-pupil planning
R . . . . . . .3. Immediate goal, teacher assigns work
E . . . . . . .4. Immediate goal, teacher-pupil planning

B. WORK

Teacher Directed

R . . . . . . .5. Teacher gives directions for current activities
R . . . . . . .6. Teacher lectures
R . . . . . . .7. Teacher reads to class
8. Listening to outside speaker
9. Listening to tapes or records
10. Viewing slides, films, pictures
R . . . . . . 11. Oral reading, by turns
R . . . . . . 12. Prepared oral reading
R . . . . . . 13. Drill
R . . . . . . 14. Recitation (teacher questions, pupils answer)
15. Teacher answers pupils questions
E . . . . . . 16. Teacher led discussion or blackboard work

Pupil Directed

E . . . . . . 17. Silent reading of pupil selected material
18. Silent reading of assigned material
19. Individual seat work or blackboard work
E . . . . . . 20. Sub-groups and individual seat work
E . . . . . . 21. Sub-groups working
E . . . . . . 22. Pupil led discussion

C. EVALUATION

Teacher Directed

23. Test
24. Correcting papers or homework
25. Teacher led discussion

Pupil Directed

26. Individual reports
27. Group reports
28. Pupil led discussion

D. ADMINISTRATIVE MATTERS AND NON-UNIT ROUTINE PROCEDURES

29. Pencil sharpening
30. Settling down (wasted time)
31. Clean up
32. Necessary routine; return papers, record grades
33. Administrative details
34. Break
35. Non-unit activities
36. Games (this activity was found in only one class)

* Participation restricted
**Participation expanded

The Control of Student Traits

Controlling ability:--In this field study it was impossible to assign students to teachers and balance classes so that they were equal in ability. This means that the ability of the various classes must be assessed by some measure that is independent of the teacher's ability. Before any units of study were started, a Kuhlmann-Finch test of intelligence was administered to all classes. The results of this test are shown in Tables Twenty-eight and Twenty-nine.

Table Twenty-eight

MEANS AND VARIANCE OF I.Q. MEASURE IN MATHEMATICS CLASSES

Teacher Style	Class Code	N	Mean	Variance
Indirect N = 7	D 804	33	115.00	100.19
	C 801	23	108.26	91.75
	I 801	23	106.52	83.44
	P 805	35	107.40	128.66
	A 803	28	102.43	67.07
	M 805	33	104.97	121.53
	V 803	29	115.76	130.12
	All Ss	204	108.74**	124.46
Direct N = 9	M 802	25	107.60	194.67
	G 801	20	98.10	202.41
	V 804	23	117.87	81.39
	H 802	31	104.29	86.15
	L 803	17	95.88	53.11
	T 802	23	110.57	157.53
	E 802	21	107.00	97.50
	A 802	22	103.77	161.04
	G 802	16	95.88	84.25
	All Ss	198	105.22**	164.04

**C. R. = 2.95

Table Twenty-nine

MEANS AND VARIANCES OF I.Q. MEASURE IN SOCIAL STUDIES CLASSES

Teacher Style	Class Code No.	N	Mean	Variance
Indirect N = 7	R 701	28	110.68	109.04
	P 703	24	105.38	131.03
	C 704	25	112.64	121.91
	L 706	33	119.91	95.27
	H 704	26	112.96	95.40
	P 701	28	109.89	149.43
	M 701	29	112.17	145.50
	All Ss	193	112.27**	134.05
Direct N = 8	R 702	29	113.00	143.36
	F 701	30	110.87	136.88
	D 706	27	99.67	109.77
	Q 701	25	114.00	90.33
	A 701	24	105.88	96.64
	D 708	29	111.10	53.17
	G 703	21	102.05	108.65
	B 704	30	99.27	86.13
	All Ss	215	107.11**	137.30

**C. R. = 4.47

These data indicate that both the social studies and mathematics classes are not equal in measures of intelligence. A simple critical ratio test of significance between means was applied to the I.Q. data of both mathematics and social studies. For mathematics, C.R.=2.95 and for social studies, C.R.=4.47. These differences are significant. The major conclusion is that the achievement data should be analyzed by a statistic which takes into account the initial ability of the students. An analysis of covariance of the pre- and post-achievement test data is called for.

The control of dependence proneness:--A dependence proneness test, described earlier, was administered to each student in the project. These scores are considered relatively stable and are used primarily to classify students in arbitrarily defined groups. In the analysis of the data, special comparisons will be made of student groups formed from the top third, middle third and bottom third of the distribution of dependence proneness.

The Implications of Control Data for the Analysis of the Dependent Variables

The first step in the analysis of the dependent variable "achievement" is to make adjustments between classes for differences in ability. In both mathematics and social studies adjusted final achievement scores were calculated by an analysis of covariance. Final scores were adjusted by the single variable of achievement pre-test scores. Once adjusted final test scores were punched on I.B.M. cards, special sorts could be made for the various types of students in order to compare classes grouped according to the teacher's pattern of influence.

Six groups of students will be used based on two traits. For I.Q. the experimental population is divided into top 25 per cent, middle 50 per cent, and bottom 25 per cent. For dependence proneness, three groups formed from equal thirds will be used.

In both mathematics and social studies, classes can be arranged into five groups according to teacher influence. First, for the sake of completeness, the direct and indirect groups formed from the simple I/D ratio will be compared. Next, a fairer test of the basic hypotheses can be made by comparing the most direct with the most indirect classes. Again, for the sake of completeness, the group formed from classes of teachers with average influence patterns will be included.

Chapter Five

THE RESULTS OF THE TWO YEAR PROJECT

Overview of the Findings

Taking the entire project into consideration, the hypotheses and theories stated in Chapter Two are well supported. Many of the expected significant outcomes of the first year failed to appear, but for each hypothesis relevant data from the second year supplied the necessary support. In no instances are there significant outcomes that reject any of the theoretical propositions of the study.

The hypothesis that direct influence when goals are ambiguous produces less learning is supported by analyses of the second year data in both mathematics and social studies as well as in the first year geometry experiments, particularly for dependent prone students. The hypothesis that direct influence increases learning when goals are clear is confirmed by an analysis of the second year indirect teachers during the latter stages of their two week units of study. The hypothesis that indirect influence increases learning when goals are ambiguous is supported by an analysis of the early stages of the second year units of study and by the first year geometry experiments.

The first year experiments in social studies failed to provide significant outcomes. Many of the analyses of the first year geometry data failed to provide significant outcomes. The evidence concerning the effects of teacher influence on dependence is not consistent, in spite of our efforts to create carefully controlled experimental conditions during the first year.

It is difficult to determine the inadequacies of the first year experiments. In retrospect, we now realize that the pilot runs should have gone beyond the stage of merely verifying the control of the independent variables, which appeared to be working beautifully, and included a check of the outcome variables. Much more work will be necessary to create more realistic manipulations and measures of the students' goal perceptions. More effective methods for assessing spontaneous acts of dependence are also necessary in future research. Finally, any experiments involving measures of learning achievement should involve longer work periods than those of the first year.

Some of the most interesting analyses are concerned with the flexibility of teacher influence. The evidence of the second year indicates that the theoretical speculations about flexibility in Chapter Two are essentially correct. The study also shows that indirect influence patterns on the whole stimulate more achievement than direct, regardless of ability.

There is almost no evidence in this study that the above average, average or below average students respond differently to direct and indirect patterns of teacher influence. In such classrooms, students have more positive attitudes toward the teacher, the class activities, and the material being learned.

One problem in writing this report concerns how much material should be presented, particularly when the analysis does not support the theory being tested and when there is no significant trend rejecting the theory. The more scholarly admonition that all results must be reported becomes less attractive when the reader is required to wade through pages of data that prove nothing. Faced with this problem, our policy will be not to report all the data. Over one hundred analyses of variance and covariance will not be presented, even though the results will be mentioned briefly. When a constructive conclusion is stated, the complete analysis supporting the statement will be included.

The rest of this chapter reports the findings of the first year laboratory experiments and the second year field experiments. The analysis of achievement is mentioned first in both sections. What little evidence we have collected concerning dependence will be found in the first year section. The analysis of the use of time and flexibility of teacher influence are found in the second. The chapter ends with a summary.

The Results of the First Year Experiments

The measures of achievement in the geometry experiments:--A separate analysis was made for above average I.Q., average I.Q., below average I.Q., independent and dependent students on pre and post measures of achievement. The statistical procedure used was to make an analysis of variance of the pre-test measure among the four experimental treatments separately for each of the five categories of students. If no significant F-ratios appeared in the pre-test analysis of variance, then a similar analysis was made of the post-test measures. If F-ratios above 1.0 appeared in the pre-test analysis, then an analysis of covariance was made adjusting for pre-test measures.

None of the analyses of achievement or achievement recall six weeks later in social studies produced significant results.

In geometry all trends were in a direction consistent with the theorectical predictions with respect to teacher influence, but there were no consistent trends between clear and ambiguous goal treatments.

In the analysis of geometry achievement scores for students of above average and below average I.Q., no significant differences were found. For the average group, the differences were significant at the 0.05 level. These results are shown in Tables 30 and 31.

Table Thirty

ANALYSIS OF VARIANCE FOR AVERAGE I.Q. STUDENTS
ON MEASURES OF GEOMETRY ACHIEVEMENT

Source of Variance	d.f.	S.S.	M.S.	F
		PRE-TEST		
Error	268	3453.883	12.887	
Interaction		.085		--
Influence		4.765		--
Goal Perception		.530		--
		POST-TEST		
Error	268	31,117.398	11.632	
Interaction		3.533	3.533	--
Influence		57.444	57.444	4.938*
Goal Perception		3.092	3.092	--

*Significant at .05 level of confidence.

Table Thirty-one

MEANS FOR AVERAGE I.Q. STUDENTS ON MEASURES OF GEOMETRY ACHIEVEMENT

Treatment	Pre	Post
Direct-Clear	6.29	8.66
Direct-Ambiguous	6.17	8.65
Indirect-Clear	6.52	9.35
Indirect-Ambiguous	6.47	9.79
All Direct	6.23	8.65 *
All Indirect	6.50	9.57

*Significant at the 0.05 level of confidence.

The results for the independent prone geometry students were not significant in an analysis of covariance. The results for dependent prone students were significant at the 0.01 level of confidence. These results are shown in Tables 32 and 33.

Table Thirty-Two

ANALYSIS OF VARIANCE FOR DEPENDENT PRONE STUDENTS ON MEASURES OF GEOMETRY ACHIEVEMENT

Source of Variance	d.f.	S.S.	M.S.	F
		PRE-TEST		
Error	136	2108.229	15.501	
Interaction		6.429		--
Influence		1.286		--
Goal Perception		.114		--
		POST-TEST		
Error	136	1748.760	12.852	
Interaction		5.375	5.375	--
Influence		98.684	98.640	7.67**
Goal Perception		.064	.064	--

**Significant at 0.01 level of confidence.

Table Thirty-Three

MEANS FOR DEPENDENT PRONE STUDENTS ON MEASURES OF GEOMETRY ACHIEVEMENT

Treatment	Pre	Post	
Direct-Clear	6.97	9.42	
Direct-Ambiguous	7.45	9.06	
Indirect-Clear	7.60	10.60	
Indirect-Ambiguous	7.22	11.05	
All Direct	7.21	9.24	**
All Indirect	7.41	10.82	

**Significant at the 0.01 level of confidence.

There is the possibility that some of our theoretical hypotheses would have been supported if all scores had been analyzed regardless of I.Q. groups. To test our hypotheses by this procedure would be a violation of the experimental design and was not carried out. The superiority of indirect influence for two overlapping groups in geometry is interesting, but not conclusive. However, these results in geometry are supported conclusively by the results of the second year.

Turning now to the first year analysis of dependence, we again are confronted with nonsignificant comparisons. There are, however, some nonsignificant trends that we will report. They are of interest as leads in future research.

The data in Tables 34 and 35 show the means of each administration of the dependence measure. To the right, in each table, the shift in each mean is illustrated starting from a common point. The solid line represents the direct treatments and the dash line the indirect treatments. An average decrease of one and one-half points consistently occurs between the means of the first and second measures. This represents a decrease in feelings of dependence that one would normally expect due to the contact with the teacher that occurs between the first and second measures. These data indicate that the immediate effect of the lecture-discussion was to reduce the students' dependence on the teacher. In both geometry and social studies indirect influence produced a lower final level of dependence shown by the third measure administered at the end of the work period. In other words, contact with any kind of teacher tended to reduce dependence, but the difference between direct and indirect influence appeared after the work period was completed. The lower level of dependence resulting from contacts with an indirect teacher is consistent with our theory.

Table 34

DEPENDENT TENDENCIES OF ALL STUDENTS IN THE DIRECT AND INDIRECT GEOMETRY EXPERIMENTS

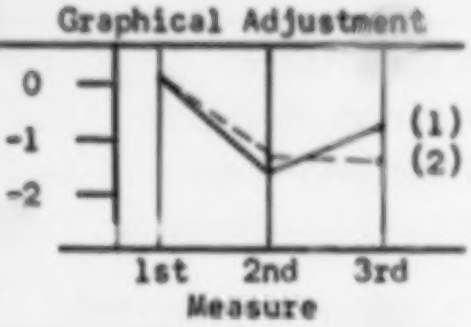
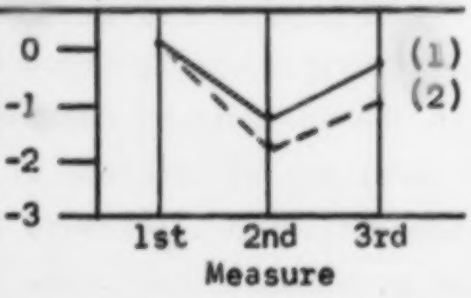
Teacher Influence	Means			Graphical Adjustment
	First	Second	Third	
(1) Direct	17.5	15.1	15.9	
(2) Indirect	15.9	13.9	13.7	
N = 280 for each mean				

Table 35

DEPENDENT TENDENCIES OF ALL STUDENTS IN THE DIRECT AND INDIRECT SOCIAL STUDIES EXPERIMENTS

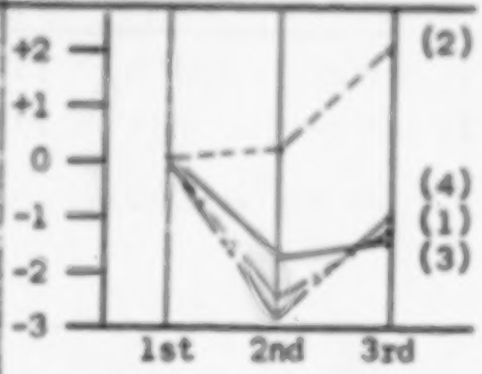
Teacher Influence	Means			Graphical Adjustment
	First	Second	Third	
(1) Direct	14.6	12.5	14.0	
(2) Indirect	15.6	13.2	14.3	
N = 240 for each mean				

Note: In the graphical adjustment the solid line = direct and the broken line = indirect.

Support for the theoretical prediction that direct influence when goals are clear produces less dependence than direct influence when goals are ambiguous was found in only one set of scores. These data were for the dependent prone students in social studies and are shown in Table 36. The corresponding data for geometry showed practically no difference between treatments.

Table Thirty-six

DEPENDENT TENDENCIES OF DEPENDENT PRONE STUDENTS IN SOCIAL STUDIES

Treatment	Means			Graphical Adjustment
	1st	2nd	3rd	
(1) Direct-Clear	14.9	12.5	13.5	
(2) Direct-Ambiguous	12.8	12.9	14.9	
(3) Indirect-Clear	14.1	12.4	12.7	
(4) Indirect-Ambiguous	12.5	10.1	11.4	
N = 35 for each treatment				

Our theories concerning dependence must remain hypotheses. The foregoing trends encourage us to continue our efforts to design better techniques for assessing dependent behavior and to make use of these in some future research design.

Summary of the first year:--The major hypotheses concerning the effects of direct and indirect teacher influence on achievement were supported in the analysis of dependent prone students studying geometry at the 0.01 level and by students of average I.Q. at the 0.05 level. We also obtained additional evidence about the teacher influence patterns preferred by students who score high and low on the dependence proneness test that will be reported elsewhere.

In spite of the successes achieved in the control of the independent variables in the first year research design, differences in the outcome variables were not as significant as we would have wished.

The Results of the Second Year

Adjusting achievement scores to make them comparable:--The analysis of achievement data must take into consideration the significant differences in initial ability among the various classes. Tables Twenty-eight and Twenty-nine, pages 77 and 78, show that the I.Q. means of the mathematics classes are quite variable and that the indirect classes in social studies have a combined mean that is significantly higher than the direct classes. This evidence suggests that there was unequal initial ability between classes. Such conditions require a covariance analysis to adjust final scores to compensate as best we can for these differences. Some such adjustment is also required in view of our intention to compare the achievement of dependent and independent prone students. A covariance analysis of mathematics and another of social studies achievement scores was carried out providing final achievement scores that were adjusted for initial ability. Such an adjustment is only partial and does not completely eliminate the factor of initial ability.

In such an analysis the first decision to be made is whether the extra work involved in adjusting final scores by I.Q. as well as pre-test performance is justified compared with adjusting by pre-test only. The following correlations shown in Table 37 led us to the conclusion that adjustment by pre-test only was satisfactory.

Table Thirty-Seven

PRELIMINARY CORRELATIONAL ANALYSIS

Comparison	Mathematics	Social Studies
I.Q. vs. pre-test	0.600	0.502
I.Q. vs. post-test	0.697	0.582
I.Q. vs. gain score	0.323	0.196
Pre-test vs. post-test	0.823	0.625

It can be seen that the correlation between I.Q. and the pre-test is not significantly different from the correlation between I.Q. and the post-test. The extra work involved in using both I.Q. and pre-test to determine regression was not justified.

The analysis of covariance for each subject matter field is shown in Table 38. The significant F-ratios were found rejecting the hypothesis that there are no differences of variation between classes. Differences between classes were expected even when final scores were adjusted for initial ability. The major benefit of the analysis was to determine a single regression equation by which all individual post-test achievement scores could be adjusted. The pre-test and post-test achievement scores, before adjustment, can be found in Appendix D, Tables One and Two, pp. 1-2.

The adjusted final achievement scores will be used in the sections that follow as the basic measure of achievement. These scores, which take into account the initial ability of the students, were punched on I.B.M. cards so that different sorts could be made to compare the achievement of different types of students.

Table Thirty-eight

ANALYSIS OF COVARIANCE CONTROLLING PRE-TEST ACHIEVEMENT IN MATHEMATICS AND SOCIAL STUDIES

Content	Source of Variation	d.f.	S.S.	M.S.	F
Social Studies	Within classes	416	10,102.65	24.29	
	Between classes	15	3,199.70	213.31	8.78**
	$\beta = 0.63$			(0.01 is 2.08)	
Mathematics	Within classes	369	12,661.52	34.313	
	Between classes	15	3,658.52	243.901	7.11**
	$\beta = 0.96$			(0.01 is 2.09)	

Achievement scores of the indirect-direct I/D split:--Did the students in the classes called indirect, based on a simple rank order of the I/D ratio, achieve more than the students in the direct classes? The answer to this question is affirmative for both social studies and mathematics.

In Table 39 the achievement of the seven indirect classes is compared with the eight direct classes for social studies. The difference between a mean of 36.4 and 33.8 is significant beyond the 0.01 level.

The significance was determined by a critical ratio test indicating that C.R. = 4.24. Similarly, in Table 40 the difference between the mathematics means of the seven indirect and nine direct classes shows superior achievement in the indirect classes and yields a C.R. = 3.42.

The use of the critical ratio, here and elsewhere in this chapter, might be criticized by those who would prefer a "t" test. The critical ratios cited in support of conclusions in this section and in the one that follows all involve an "N" of 90 or larger. All these critical ratios are larger than 3.00. Given the size of the "Ns" and the magnitude of the C.Rs., the comparisons are significant well beyond the 0.01 level regardless of the test of significance used.

In those mathematics and social studies classrooms in which the teacher has a higher I/D ratio, the students scored significantly higher on a measure of achievement controlled for initial ability. There is no evidence to support the notion that students of above average, average, or below average I.Q. respond differently to direct and indirect influence.

Table Thirty-nine

MEANS AND VARIANCE OF ADJUSTED FINAL TEST BY I.Q. GROUP, SOCIAL STUDIES

Teacher Style	Intelligence I.Q. Group	Mean I.Q.	N	Adjusted Final Test Mean	Variance
Indirect N = 7	High	124.7	59	38.7	13.3
	Average	110.9	91	36.3	20.5
	Low	94.8	33	33.0	38.2
	All Ss	112.4	183	36.4**	34.2
Direct N = 8	High	123.3	38	35.7	18.9
	Average	109.2	101	33.8	31.2
	Low	93.8	59	31.1	38.4
	All Ss	107.3	198	33.4**	33.4

**C.R. = 5.02

Table Forty

MEANS AND VARIANCE OF ADJUSTED FINAL TEST BY I.Q. GROUP, MATHEMATICS

Teacher	INTELLIGENCE			ADJUSTED FINAL TEST	
Style	I.Q. Group	Mean I.Q.	N	Mean	Variance
Indirect N = 7	High	122.1	51	31.3	44.7
	Average	106.9	100	28.9	38.7
	Low	93.1	33	24.2	30.0
	All Ss	108.7	184	28.7**	43.5
Direct N = 9	High	122.9	42	29.3	40.1
	Average	107.1	77	27.3	38.8
	Low	91.6	60	23.3	23.7
	All Ss	105.6	179	26.4**	38.8

**C.R. = 3.42

In addition to showing higher achievement, the students in the indirect classes scored higher class averages on a revised and longer form of a test on student attitudes. A copy of this test can be found in Appendix D, pp. 3-8. This test included the thirty items of the M.S.A.I., short form, used to select the original sample. Additional items were added and the response to each item was extended to a four point scale. The difference between a mean of 248 and a mean of 227, in Table 41, yields a C.R. = 5.33 in social studies. The same critical ratio in mathematics, from Table 42, is 4.98. These scores indicate that the students perceived the total classroom situation in a more favorable light along the same dimensions mentioned in Chapter 4, pp. 41-42.

This is the first evidence we have collected in our six year research program indicating that when student attitudes are more favorable, higher achievement also occurs. A simple product-moment correlation of the class means of adjusted post-test scores and M.S.A.I. (long form) scores is 0.44 for mathematics and 0.45 for social studies. Further item development and analysis will be carried out on the M.S.A.I. with the expectation that an improved attitude test will correlate higher with achievement.

Table Forty-one

M.S.A.I. (LONG FORM) CLASS AVERAGES IN SOCIAL STUDIES

Teacher Style	Class Code	N	Mean	Variance
Indirect	C 704	23	259	692.6
	H 704	24	229	1139.4
	L 706	34	220	1336.7
	M 701	29	253	1314.2
	P 703	22	263	726.5
	R 701	24	261	1305.0
	P 701	24	264	621.7
	All Ss	180	248**	1317.3
Direct	B 704	24	206	785.3
	D 706	23	201	895.1
	G 703	19	267	275.4
	Q 701	28	199	2182.9
	A 701	20	216	1075.5
	D 708	28	269	856.1
	F 701	27	233	863.5
	R 702	27	224	607.9
	All Ss	196	227**	1614.8

**C.R. = 5.33

Table Forty-two

M.S.A.I. (LONG FORM) CLASS AVERAGES IN MATHEMATICS

Teacher Style	Class Code	N	Mean	Variance
Indirect	A 803	29	248	963.0
	C 801	21	258	896.8
	D 804	32	262	990.4
	I 801	22	255	700.7
	P 805	33	273	438.1
	V 803	21	222	730.0
	M 805	29	247	610.7
	All Ss	187	254**	933.9
Direct	E 802	22	209	1037.0
	H 802	27	229	1468.9
	M 802	26	258	471.4
	V 804	25	254	849.8
	A 802	19	237	625.5
	G 801	16	261	380.3
	G 802	17	196	551.2
	L 803	15	267	826.2
	I 802	20	225	560.1
	All Ss	187	237**	1242.0

**C.R. = 4.98

Achievement in the most direct and most indirect classes:--Did the classes exposed to a more consistent indirect or direct pattern of teacher influence show even greater differences than were found in the preceding section? Again, the answer to this question is affirmative for both mathematics and social studies.

The procedures used to select teachers whose patterns were more consistently direct or indirect were described in the preceding chapter. These teachers provide the best comparison of direct and indirect patterns of influence. Tables 43 and 44 show how above average, average, and below average students achieved in the most indirect, average and most direct classrooms.

Table Forty-three

THE COMPARISON OF ACHIEVEMENT IN THE MOST DIRECT AND MOST INDIRECT SOCIAL STUDIES CLASSROOMS

Teacher Style	Intelligence I.Q. Group	Mean I.Q.	N	Adjusted Final Test Mean	Variance
Most Indirect N = 6	High	124.5	53	38.7	14.0
	Average	110.9	76	36.2	20.2
	Low	94.9	27	34.2	27.0
	All Ss	112.7	156	36.4**	20.4
Average N = 5	High	124.4	31	36.2	16.7
	Average	110.1	76	35.9	21.8
	Low	94.9	26	32.7	59.9
	All Ss	110.5	133	34.9	32.8
Most Direct N = 4	High	122.1	13	25.9	23.4
	Average	108.0	40	30.9	32.0
	Low	93.2	39	29.5	25.3
	All Ss	103.7	92	31.0**	31.8

**C.R. = 7.73

Table Forty-Four

THE COMPARISON OF ACHIEVEMENT IN THE MOST DIRECT AND MOST INDIRECT MATHEMATICS CLASSES

Teacher Style	Intelligence I.Q. Group	Mean I.Q.	N	Adjusted Mean	Final Test Variance
Most Indirect N = 6	High	122.1	46	31.3	46.6
	Average	106.9	84	28.9	34.8
	Low	89.6	26	24.4	31.5
	All Ss	109.2	156	28.9**	42.3
Average N = 5	High	122.5	36	30.0	40.2
	Average	107.5	52	28.7	44.4
	Low	94.1	29	24.0	16.8
	All Ss	108.7	117	27.9	33.7
Most Direct N = 5	High	124.0	11	28.0	36.4
	Average	106.5	41	26.0	35.1
	Low	89.8	38	22.7	28.7
	All Ss	101.6	90	24.9**	33.3

**C.R. = 5.00

The group means of most importance in Tables 43 and 44 are those of the most indirect and most direct groups. The superior achievement of the indirect groups becomes more evident when classes are selected more carefully by analyzing the entire interaction matrix. In other words, as the influence pattern of the teachers approaches a more consistent direct or indirect pattern, the differences in achievement, in the predicted direction, become larger.

In the social studies classes, we see for the first time some evidence that higher I.Q. students are more affected by the differences of the direct and indirect pattern of influence than are other students. The evidence in Table 43 is shown by the following comparison: (38.7 - 25.9) - (34.2 - 29.5), which are the respective means of the high I.Q. most indirect minus the high I.Q. most direct, and the low I.Q. most indirect minus the low I.Q. most direct. The loss is significantly greater for the high I.Q. compared with both the average and low I.Q. groups beyond the 0.01 level; t = 4.41

and t = 4.48, respectively[1]. This trend is not supported in the mathematics classes, nor does it appear in Tables 39 and 40. With a larger than N = 13 sample in the high I.Q. most direct group, this difference could disappear. We are inclined to consider this difference an artifact.

One of our theoretical expectations from the first year was that students scoring high on the dependence proneness test would react differently to patterns of direct and indirect influence. This expectation was not supported in the analysis of achievement scores of the most indirect and most direct classes. The data, Table 45, indicate that the dependent prone are no different from the independent prone in their achievement in the most indirect and direct classes.

Table Forty-five

ADJUSTED ACHIEVEMENT MEANS OF HIGH, MEDIUM, AND LOW DEPENDENT PRONE STUDENTS IN SOCIAL STUDIES AND MATHEMATICS

				Adjusted Achievement	
Influence	Type of Dependence	Dependence Score	N	Mean	Variance
Soc. Studies Most Indirect	High	37.2	60	36.6	21.0
	Medium	32.2	58	36.2	24.9
	Low	26.4	41	36.9	19.6
Soc. Studies Most Direct	High	37.3	24	30.5	25.5
	Medium	32.2	26	30.8	28.2
	Low	25.8	32	30.1	36.2
Mathematics Most Indirect	High	36.7	56	29.1	41.0
	Medium	31.7	47	28.2	43.0
	Low	24.3	50	38.8	41.2
Mathematics Most Direct	High	36.0	26	25.2	34.1
	Medium	31.0	27	25.2	33.4
	Low	25.7	31	24.1	52.9

---

[1] $$t = \frac{(x_a - x_b) - (x_c - x_d)}{s_p\left(\frac{1}{N_a} + \frac{1}{N_b} + \frac{1}{N_c} + \frac{1}{N_d}\right)^{\frac{1}{2}}}$$ where a and b are indirect and direct high I.Q. and c and d are indirect and direct low I.Q., for example.

The use of time by direct and indirect teachers:--In this section the amount of time spent in planning, work, evaluation, and routine administrative matters will be reported for direct and indirect teachers. The time periods refer only to those occasions when the observer was present. Teacher daily log reports on the use of time were discarded as too inaccurate.

There was very little difference in the over all use of time. In Table 46 the per cent of time spent in the four basic activities is shown for every minute that an observer was in a classroom. The indirect social studies teachers spent slightly more time at work, but the distribution is remarkably similar. The indirect mathematics teachers spent more time planning, less in work and more in evaluation, but again, the distribution follows roughly the same pattern.

Table Forty-six

USE OF TIME DURING THE TWO WEEK UNITS OF STUDY IN MATHEMATICS AND SOCIAL STUDIES

Activity	Social Studies			Mathematics		
	Indirect N = 7	Sig.	Direct N = 8	Indirect N = 7	Sig.	Direct N = 9
Planning	8.7	--	7.3	3.3	<.01	0.8
Work	69.9	<.05	65.6	70.9	<.01	79.9
Evaluation	13.5	---	14.8	19.7	<.01	13.0
Routine	7.9	<.01	12.3	7.1	--	6.3
Total %	100		100	100		100
Total N*	3005		3299	2097		2731

*"N" is given in minutes because the observers records were accurate within plus or minus a minute by use of the classroom clock. Depending on the split, a percentage difference of between three to six per cent is significant at the 0.01 level with a total N of 2,000 or more. For example, the difference between 3.3 and 0.8% in mathematics planning is significant beyond the 0.01 level using a common test of significance of the difference between two per cents or by a Chi-square test of the raw data in minutes.

Since such a test of significance is affected by the total N, a choice of hours as the unit of time produces data that have NO significant comparisons. There are three reasons for choosing minutes as the unit of time. (1) Period of activity were nearly always less than one hour, some less than five minutes. (2) Variability of practice between teachers required the most accurate time unit. (3) The observer is justified in reporting information in the smallest unit consistent with accuracy.

Comparisons between direct and indirect teachers that are significant are indicated either as less than 0.05 or less than 0.01.

When the record of how time was spent is divided into the three time periods of the first two days, the middle period, and the last two days, more differences appear between direct and indirect teachers. In Tables 47 and 48 the distributions for the same four categories are shown separately for the three time periods.

Table Forty-seven

USE OF TIME DURING THE BEGINNING, MIDDLE, AND TERMINAL PHASES OF THE SOCIAL STUDIES UNITS

Activity	First Two Days			Middle Period			Last Two Days		
	Ind.	Sig.	Dir.	Ind.	Sig.	Dir.	Ind.	Sig.	Dir.
Planning	17.2	--	19.4	5.5	<.01	1.4	2.9	--	2.0
Work	68.6	--	65.7	73.0	<.01	66.1	64.0	--	64.4
Evaluation	5.8	<.05	3.2	14.6	<.01	19.8	23.3	--	21.8
Routine	8.4	<.01	11.7	6.9	<.01	12.7	9.8	<.01	1.8
Total %	100.0		100.0	100.0		100.0	100.0		100.0
Total N*	951		1068	1472		1674	582		557

*See footnote Table 46

Table Forty-eight

USE OF TIME DURING THE BEGINNING, MIDDLE, AND TERMINAL PHASES OF THE MATHEMATICS UNITS

Activity	First Two Days			Middle Period			Last Two days		
	Ind.	Sig.	Dir.	Ind.	Sig.	Dir.	Ind.	Sig.	Dir.
Planning	5.5	<.01	0.4	1.1	---	1.0	6.4	<.01	1.1
Work	74.2	<.01	89.6	69.4	<.01	77.4	73.8	--	76.8
Evaluation	12.7	<.01	4.3	24.0	<.01	17.5	15.1	--	16.0
Routine	7.6	--	5.7	4.5	--	4.1	4.7	--	6.1
Total %	100.0		100.0	100.0		100.0	100.0		100.0
Total N*	487		827	1139		1248	471		656

*See footnote Table 46

Social studies planning, Table 47, occurs primarily during the first two days, then decreases more rapidly in the direct classes. Significantly more work is possible in the indirect classes during the middle period. Evaluation starts sooner in the direct classes.

There is less planning in mathematics, compared with social studies, as indicated by the per cent figures of Table 48. There is more planning in the indirect classes. Time spent at work is significantly higher in the direct classes. Evaluation is higher in the indirect classes.

Two conclusions seem justified with regard to these descriptive categories. First, differences in the use of time are greater between mathematics and social studies than between the direct and indirect comparisons. This reflects the different teaching methods used in the two content fields. Second, those significant differences between direct and indirect classes that do appear often are in the opposite direction when social studies and mathematics are compared.

We turn now to an analysis of the evaluative categories in the use of time. These evaluative categories, (see page 76) are divided into activities which expand student participation and initiative and those that restrict these aspects of student participation. Table 49 shows the per cent of time classified within these two evaluative categories separately for the beginning, middle and end of the two week units of study. At the bottom of the table the total per cent distributions and the total number of minutes are shown. These data indicate that even though the direct and indirect teachers tend to spend time similarly when descriptive categories are compared, there are significant differences when evaluative categories are used.

These data show that direct and indirect teachers organize class activities differently. Indirect teachers in both subjects will more often choose a procedure that permits students to express their opinions and participate with greater initiative. In social studies they will less often choose activities that restrict student participation. In mathematics indirect teachers use both expanding and restricting types of activities more often.

Table Forty-nine

USE OF ACTIVITIES THAT EXPANDED OR RESTRICTED STUDENT PARTICIPATION IN MATHEMATICS AND SOCIAL STUDIES

Time Period	Type* of Activity	Social Studies Ind.	Social Studies Sig.	Social Studies Dir.	Mathematics Ind.	Mathematics Sig.	Mathematics Dir.
First Two Days	Expanding	24.9	<.01	16.7	28.7	<.01	13.8
	Restricting	9.1	<.01	32.2	31.2	--	35.8
	Neutral	65.0	<.01	51.1	40.1	<.01	60.3
Middle Period	Expanding	28.5	<.01	14.7	23.8	<.01	13.7
	Restricting	16.0	<.01	9.4	32.0	<.01	25.4
	Neutral	53.5	<.01	75.9	44.2	<.01	60.9
Last Two Days	Expanding	23.5	<.01	12.4	14.6	--	11.7
	Restricting	12.4	<.01	19.9	40.6	<.01	29.1
	Neutral	64.1	<.01	67.7	44.8	<.01	69.2
Total	Expanding	26.7	<.01	15.0	22.9	<.01	13.3
	Restricting	13.2	<.01	18.6	33.8	<.05	29.4
	Neutral	60.1	<.01	66.4	43.3	<.05	57.3
Total N**		3005		3299	2097		2731

*See page 76 for a definition of expanding and restricting activities.
**See footnote of Table 46.

There are important trends in the data of Table 49 that consistently support the basic theory of indirect and direct influence in relation to clear and ambiguous goals. These trends will be discussed in detail in the next section when they can be associated with the concept "flexibility."

Summarizing the use of time, the data indicate that when the time spent in planning, work and evaluation are summed by descriptive categories over the entire two weeks, the patterns of direct and indirect teachers are quite similar. When these summations are made separately for the first two days, the middle period and the final two days, differences lend no particular support to any theory. Instead they show that the methods used to teach mathematics are different from those used to teach social studies.

When activities are classified by evaluative categories according to their tendency to expand or restrict student participation and initiative, significant differences occur between direct and indirect classes that are consistent with our theoretical expectations. In social studies indirect teachers make use of more opportunities to expand student participation and less frequently restrict it. In mathematics indirect teachers expand and restrict student participation more often than direct teachers.

Teacher flexibility of influence:--As a teacher makes changes in the use of time during the two week period, he also shifts his direct and indirect influence. In this section we will show that changes both in teacher influence and the use of time are related to the theories stated in Chapter Two. We will show that indirect teachers are more flexible, that they tend to begin with a higher proportion of indirect influence and shift to more direct, and that these changes are consistent with their use of time.

Flexibility of teacher influence can be shown by calculating separate I/D ratios for different types of classroom activities. The wider the range of a distribution of I/D ratios, the more a teacher is modifying his influence to fit the different types of classroom activities. Figures 8 and 9 use bar graphs to illustrate the range of I/D ratios for indirect and direct teachers. The range for each teacher is shown by a separate bar in each graph. The points along each bar indicate various I/D ratios, one point for each different type of classroom activity.

In the preceding section, four descriptive activity categories were used to classify all of the minutes during which the observer was in the classroom. In this section an expansion of the previous system of descriptive categories was possible because the notes kept during interaction analysis were more complete. A comparison of the two category systems for classifying activities is shown below.

Descriptive Classroom Activities

Use of time categories	I/D analysis categories
1. Planning	1. Planning activities (social studies) 2. Introducing new material
2. Work	3. Class discussion of old material or current problems 4. Supervision of seatwork or group activities
3. Evaluation	5. Discussion of homework or test results
4. Routine-administrative	6. Routine-administrative

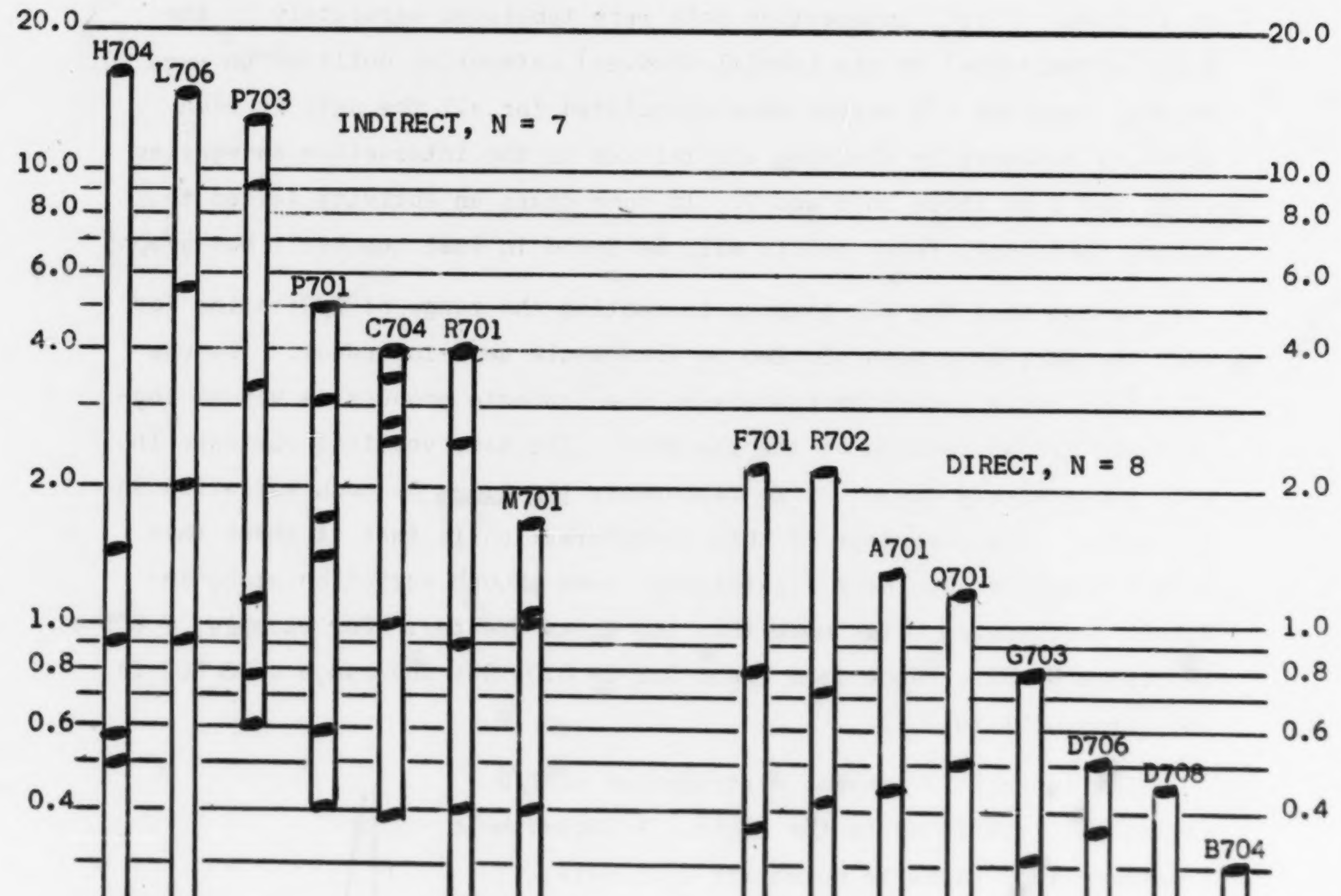


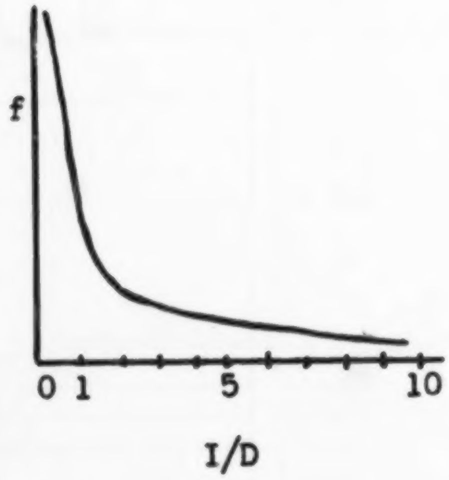
Figure 9

Range of I/D Ratios for Social Studies Teachers

The procedure of calculating the data plotted in Figures 8 and 9 is as follows. First, interaction data were tabulated separately in the five (mathematics) or six (social studies) categories outlined on page 99. Second, separate I/D ratios were calculated for all the data in each activity category by dividing all tallies in the interaction categories 1, 2, and 3 by those in 6 and 7. In some cases an activity failed to occur, therefore, fewer points will be found in that teacher's bar graph.

Notice that the bar graphs, indicating the range of I/D ratios for each teacher, have been plotted on four cycle semi-log paper. The use of a four cycle logarithmic scale on the ordinate produces a visual logarithmic transformation of the raw data. The same vertical distance in each successively higher cycle represents ten times as much variation in I/D ratio. The advantage of this transformation is that it shows that direct teachers also have flexibility, even though variation among indirect teachers is often more than ten times greater. For example, P 805 in Figure 9 has a range from about 2.2 to 8.0, but the range of G 802 is only from 0.01 to 0.72.

The typical "J" shaped distribution of I/D ratios is illustrated to the right. A logarithmic transformation tends to normalize such data.



We now turn to an analysis of how use of time and teacher influence vary over the two week unit of study. The question to be answered is whether there is any evidence that teachers increase their direct influence as goals become clear and decrease their indirect influence during the same period?

Figures 10 and 11 illustrate this shift in teacher control in social studies planning and evaluation activities. In Figure 10 evaluative activities increase with time. For these activities the average I/D ratio is less than one for both direct and indirect teachers, indicating that teachers are more direct than indirect during evaluation discussions.

In Figure 11, planning activities decrease. This is an activity in which the teachers' I/D ratios are greater than one, indicating that teacher influence is more indirect than direct.

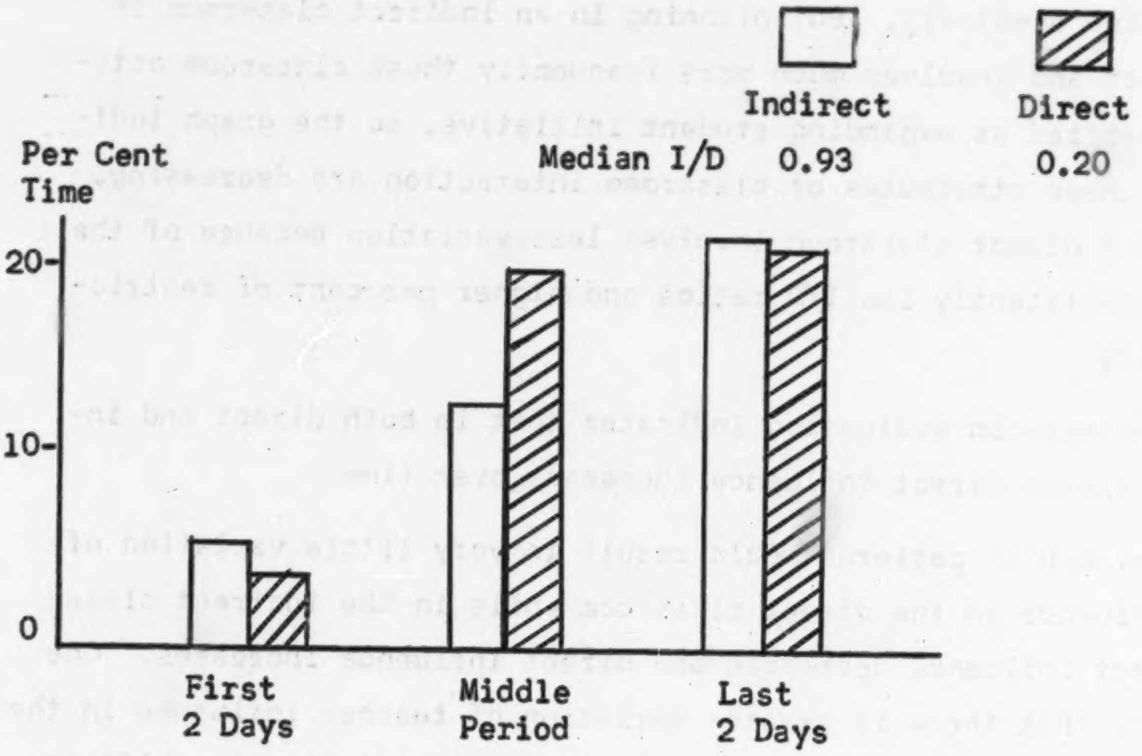


Figure 10
Social Studies Evaluation

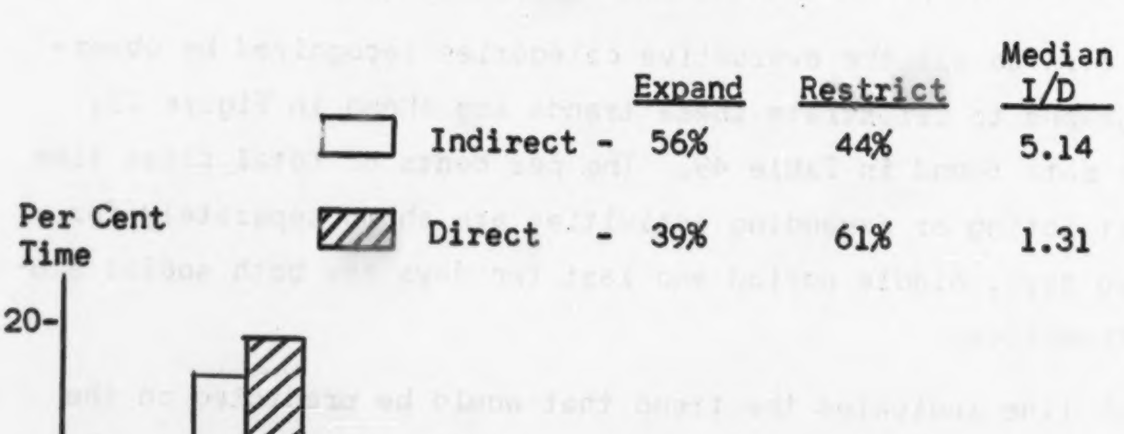


Figure 11
Social Studies Planning

Both the direct and indirect teachers vary their use of planning and evaluation similarly. But planning in an indirect classroom is more indirect and involves much more frequently those classroom activities classified as expanding student initiative, so the graph indicates that these attributes of classroom interaction are decreasing. Planning in a direct classroom involves less variation because of the teachers' consistently low I/D ratios and higher per cent of restrictive activity.

The increase in evaluation indicates that in both direct and indirect classrooms direct influence increases over time.

Combining both patterns would result in very little variation of teacher influence in the direct classroom while in the indirect classroom indirect influence decreases and direct influence increases. One can conclude that there is greater variation of teacher influence in the indirect classrooms and that teachers are initially indirect, shifting to more direct influence as progress toward learning goals occurs. This same variation is not present in the direct classrooms.

We now turn to all the evaluative categories recognized by observers. The graphs to illustrate these trends are shown in Figure 12, based on the data found in Table 49. The per cents of total class time spent in restricting or expanding activities are shown separately for the first two days, middle period and last two days for both social studies and mathematics.

The dash line indicates the trend that would be predicted on the basis of the theory outlined in Chapter Two. While there is not perfect agreement, the trends of the indirect classrooms are significantly closer to theoretical predictions than are the same trends in the direct classrooms. One can conclude from these data that the organization of activities which expand or restrict student initiative and participation follows a definite trend which is consistent with theoretical predictions in the indirect classrooms. In general, the same trends are not present in the direct classrooms. Indeed, the use of restrictive activities follows the opposite trend in the direct classrooms of both social studies and mathematics.

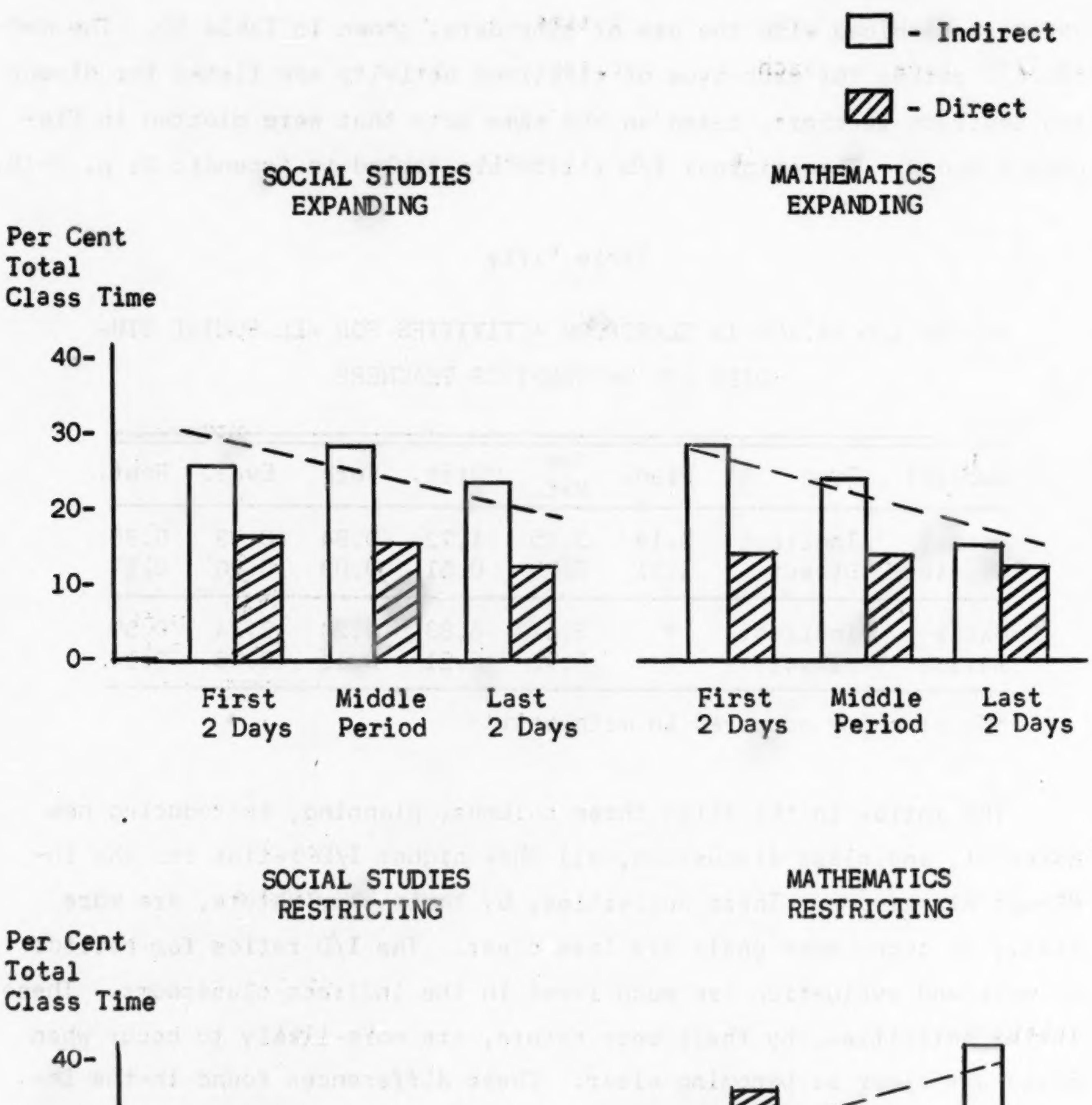


Figure 12

Shifts in Expanding and Restricting Student Initiation

The support of the theory becomes complete when teacher influence data are combined with the use of time data, shown in Table 50. The median I/D ratios for each type of classroom activity are listed for direct and indirect teachers, based on the same data that were plotted in Figures 8 and 9. The original I/D ratios are tabled in Appendix D, p. 9-10.

Table Fifty

MEDIAN I/D RATIOS IN CLASSROOM ACTIVITIES FOR ALL SOCIAL STUDIES AND MATHEMATICS TEACHERS

Subject	Type	Plan.	New Mat.	Disc.	Work	Eval.	Rout.
Social Studies	Indirect	5.14	3.25	1.72	0.84	0.93	0.30
	Direct	1.31	0.23	0.51	0.03	0.20	0.17
Mathematics	Indirect	*	3.64	6.83	2.24	2.24	0.59
	Direct	*	0.72	0.21	0.15	0.25	0.14

*No planning occurred in mathematics

The ratios in the first three columns, planning, introducing new material, and class discussion, all show higher I/D ratios for the indirect classrooms. These activities, by their very nature, are more likely to occur when goals are less clear. The I/D ratios for periods of work and evaluation are much lower in the indirect classrooms. These latter activities, by their very nature, are more likely to occur when goals are clear or becoming clear. These differences found in the indirect classrooms are consistent with our theories about teacher influence. The differences found in the direct classrooms are much less significant, show much less variation, and suggest that interaction in these classrooms does not follow our general theories.

Summary of results:--The results of this project will first be summarized in terms of the three main hypotheses. These hypotheses were first listed in Chapter Two, page 19.

(1) Direct teacher influence restricts learning when a student's perception of the goal is confused and ambiguous.

(2) Direct teacher influence increases learning when a student's perception of the goal is clear and acceptable.

(3) Indirect teacher influence increases learning when a student's perception of the goal is confused and ambiguous.

The significant differences in achievement found in the first and second years support the generalization that the teaching methods we have called indirect produce more achievement. Our classification of teachers as indirect is based on an above average proportion of indirect to direct acts of influence over an extended period of time. This evidence alone does not prove or disprove the three main hypotheses even though it does have important implications for teaching.

The support of hypotheses two and three comes from the following reasoning. First, students of teachers who used an above average proportion of indirect to direct acts of verbal influence learn more. Second, teachers with an above average proportion of indirect influence also show more variability in adapting their influence to different types of classroom activities and to the different stages of learning that are presumed to exist in a two week unit of study. Finally, the adaptations made by these more flexible teachers follow the shifts of teacher influence that are described in hypotheses two and three.

Hypothesis three states that indirect teacher influence increases learning when a student's perception of the goal is ambiguous. We assume that learning goals are ambiguous during the initial stages of a two week unit of study. The indirect teachers provided more activities that permitted students to express their own opinions and develop self initiative during the initial stages of the unit. Their verbal influence during these initial stages was much more indirect compared first, with their own two week average, and second, with the averages of direct teachers. This evidence clearly supports hypothesis three.

Hypothesis two states that direct teacher influence increases learning when a student's perception of the goal is clear and acceptable. The more flexible, indirect teachers decreased their use of activities that expanded student initiative as learning progressed. They increased their use of activities that restricted student initiative as learning progressed. At the same time they made adjustments in their own patterns of teacher influence so that they became more direct, compared only to their own average as learning progressed. This evidence clearly supports hypothesis two.

Hypothesis one has, in one sense, too much evidence to support it. The students whose teachers employed an above average proportion of direct influence consistently showed less achievement. These teachers showed less flexibility in adapting their influence to different types of classroom activity and to the different stages of learning in a two week unit of study. The evidence concerning direct influence is so consistent that the following modification of hypothesis one is justified; direct influence decreases learning except when goals have initially been clarified and made acceptable by the use of indirect influence.

In planning this project, we anticipated that different types of students would react differently to direct and indirect influence. For example, the first year results in geometry encouraged us to believe that dependent prone students are more sensitive to differences between direct and indirect patterns of influence. The significant results of this experiment still supports this hunch. However, in a practical classroom situation involving a larger population, no differences were found in achievement when dependent prone students were compared with the more independent prone. We have also found that students who are classified by I.Q. scores into the top quartile, middle 50 per cent and bottom quartile did not respond differently to teachers we classified as direct and indirect. The one exception to this in social studies, indicating that high I.Q. students were more sensitive to differences in direct and indirect influence, was not supported in larger samples. The possibility still exists that different types of students develop different attitudes toward teachers who use different patterns of influence. For example, a preliminary analysis of M.S.A.I. scores, not reported here, indicated a significant sex difference.

Perhaps the conclusion that needs to be emphasized the most in this summary is that the students who achieved the most and had significantly higher scores on our revised classroom attitude instrument were in classes which were exposed to flexible patterns of teacher influence. This flexible pattern included periods of predominantly direct influence as well as other periods of predominantly indirect influence. This characteristic flexibility was associated with a higher overall I/D average. Our data show that a sustained above average pattern of direct influence restricts learning and produces less desirable attitudes. It is obvious that as teacher influence deviates from this narrow pattern, the overall I/D must increase. These deviations are what we have called flexibility.

Chapter Six

CONCLUSIONS AND IMPLICATIONS OF THE PROJECT

Metatheory

Theorizing about theory is not a common pastime, especially in the field of education, but it is time to ask some questions about the theoretical hypotheses around which this project is organized. What kind of theorizing will be of most help in creating a theory of instruction? Can the present hypotheses contribute to a theory of instruction? These two questions will occupy our attention for a page or two before discussing the conclusions and implications.

Human behavior is such a complex and variegated pasture for theoretical foraging that the possible positions and postures of the theorist are unlimited. Theorizing about the behavior of a classroom teacher takes place in a small paddock off to one side that is crisscrossed by paths connecting the fields of learning theory, motivation, personality, group dynamics, sociometry, and practically anything else. Here it is easy to get lost, the direction signs are not well posted.

Educators are not yet ready to start the ambitious task of developing a theory of instruction that takes into account all behavior that occurs in a classroom. In one bold step of oversimplification, we postulate that a theory of instruction must at least concern itself with the teacher's acts of influence and the reactions of the students, using the goals of learning as a reference for interpretation. There must be concepts that describe teacher influence, concepts that describe student reactions, and concepts that describe learning goals. In the analysis of behavior, the order is reversed. Given particular learning goals, the students' perceptions of these goals are developed through classroom interaction. The work that follows also involves interaction. The analysis of student and teacher interaction is carried out in terms of the learning goals. It is from this frame of reference that classroom behavior makes the most sense.

In order to contribute to a theory of instruction, an hypothesis must propose a dynamic cause-and-effect relationship between learning goals, teacher behavior and student behavior. If the hypothesis is verified empirically, it can become a principle of instruction that a teacher can then use to control his own behavior. To illustrate, one of our hypothesis is that direct influence when goals are ambiguous produces high dependence on the teacher and less learning. Direct influence is a concept describing teacher behavior. It is operationally defined as the enumeration of a series of verbal statements occurring in sequence. Direct influence is theoretically defined as acts which restrict the alternative actions of the student. Goals are conceptualized along a continuum from ambiguous to clear, and are operationally defined in terms of the student's perceptions. Acts of dependence and learning are aspects of the student's behavior. Each can be assessed and given operational meaning by paper-and-pencil tests or procedures of observation. If verified, this hypothesis can become a principle because it is a cause-and-effect statement predicting the consequences of teacher behavior under certain conditions.

The ultimate value of this kind of engineering research will be tested by pragmatic criteria. As this chapter is being written, arrangements have been completed for an inservice training program in a nearby school district. The project will attempt to answer the question, if teachers learn our theories about the consequences of indirect and direct influence, will this help them become more effective teachers? The results of the present project will become part of the content of this inservice training.

Some Assumptions Inherent in our Approach

Certain assumptions are necessary in our analysis of teacher influence. First, acts of influence are expressed primarily through verbal statements. Non-verbal acts of influence do occur, but are not recorded by interaction analysis. The reasonableness of this assumption rests on the assertion that the quality of the non-verbal acts is similar to the verbal acts. To assess verbal influence is to adequately sample all influence. We are disposed to accept this assumption.

Second, how much teachers talk and what they say determines the reactions of the students. This is another way of saying that the teacher is an influential authority figure. Given the teacher's position of authority, his greater maturity, and the common expectations of students, we find this assumption reasonable.

Third, an assumption necessary to the application of these research results in any program designed to increase teacher effectiveness is that teachers can control their verbal participation in the classroom. We believe that the average teacher can control his behavior and use it as a psychological force in classroom management. He can be indirect if he chooses, or direct, according to his assessment of the situation. What we hope to provide are principles which he can use in making the choice.

These assumptions help to focus our work on the verbal participation of teachers and students. We are in the business of evaluating classroom communication in terms of the teacher's control. Our procedures tend to emphasize control processes and ignore subject matter content. The latter is important, but so is the former, and we prefer to work on one thing at a time.

The Major Conclusions

In this project we have isolated situations in which students learned more and compared these with situations in which students learned less. Our method of isolation was not to administer a test of achievement first and then study the differences in teacher behavior. Instead, we made theoretical predictions of the following sort.

First, we assessed acts of teacher influence as they occurred spontaneously in the classroom. By using the technique of interaction analysis we were able to isolate teachers who had an above average pattern of indirect influence. We found that these above average teachers differed from below average teachers in terms of their flexibility. That is, they could be just as direct as the below average teachers in certain situations, but they could be far more indirect in other situations. The net effect was a higher average of indirect influence.

Second, we predicted certain patterns that would occur among more flexible teachers. We predicted that they would be most indirect when goals were being clarified and when new content material was being introduced. We predicted that they would be most direct after goals had been clarified and when work was in progress.

Finally, we predicted that the students of those teachers who were less flexible would learn less as measured by our achievement tests. It was by this experimental procedure that we isolated classes of higher achievement and classes of lower achievement.

When we initially contacted teachers to solicit their participation in the project, we told them that we expected that certain types of students would learn more working with direct teachers and other types of students would learn more working with indirect teachers. We were wrong. All types of students learned more working with the more flexible teachers. We also thought that classes in the field of mathematics might learn more working with a direct teacher and that classes in the field of social studies would learn more working with an indirect teacher. Again we were wrong. It is true that teachers of mathematics use time and methods differently than do teachers of social studies, but in both content areas, the students of the more flexible teachers scored higher on the achievement tests.

We are not prepared to discard these notions that particular types of students will work more effectively toward learning goals with particular types of teachers even though our field studies failed to provide support. In a series of geometry experiments, during the first year, we found significant differences indicating that dependent prone students learned more than independent prone students working with a more indirect teacher. Perhaps subsequent analysis of our present second year data will reveal what types of students learned the most working with direct teachers. Furthermore, there are a number of improvements that can be made in our methods of classifying students into types and these should be tried out before discarding what, at first glance, seems most reasonable.

Another analysis that can be made with our present data is to factor analyze student attitudes toward direct and indirect teachers. An item analysis of the factors in the M.S.A.I. test separately for our five types of students may reveal that different attitudes develop from contacts with different types of teachers, even though these attitudes did not affect achievement in this study.

Some Implications of the Research

Implications for classroom teachers:--To those of us on the staff, the most interesting implication of the project is concerned with the timing of direct and indirect influence. We find this most interesting because our theoretical predictions are contrary to accepted practice. Nearly all teachers agree that immediate action should be taken in any situation in which the learning goals are ambiguous and students do not know what to do. Students who are unable to go on with their work are wasting time. Something should be done! So far we are all in agreement.

Should the initial contacts made by a teacher in such a situation be direct or indirect? Our theory suggests an indirect approach; most teachers use a direct approach. Teachers can find many reasons to justify their direct approach. Often they think that to tell the students what to do is only reminding them of something they already know. Sometimes teachers are quite sure that the students are lazy or pretending confusion. A direct approach is more efficient and a teacher is a busy person. These and many other reasons are often mentioned by teachers as a justification for the following pattern: (a) the teacher decides students are confused; (b) the teacher makes his best guess as to the cause of this confusion; and (c) the teacher, acting on his own diagnosis, proceeds to give information, direction, and in some cases criticism, in order to help the group continue its work.

The two most common situations in which a teacher faces this choice are when new material is being introduced, for example, a new topic, a new procedure, or a new method of problem solving and when a group already at work runs into difficulty, for example, Johnny won't cooperate, information cannot be found, the answer doesn't check with an independent proof, materials are missing, and so forth.

It is obvious to any person with teaching experience that no generalization can be made at this point of the discussion that will always be true. That is, it is obvious that there will be some situations in which a teacher should be primarily direct and others in which he should be primarily indirect. However, we can make a statistical generalization which will hold for 100 such situations. The teachers of students who learned less too often employed a pattern of direct influence in this situation. Our theory predicts higher achievement and less dependence when goals are clarified by an indirect approach.

An indirect approach will stimulate verbal participation by students. It is a way of providing the teacher with the students' perceptions of the situation, regardless of whether these perceptions are correct or incorrect. Such an approach not only provides the teacher with more information, but it often results in the students developing more responsibility for diagnosing their difficulties and suggesting a plan of action.

A direct approach increases student compliance to teacher opinion and direction. It conditions students to seek the teacher's help and to check with the teacher more often to be sure they are on the right track.

A second implication for classroom teachers is that the major differences in the use of influence between the teachers whose students learned the most and those whose students learned the least are illustrated by categories one, two and three. The direct teachers lack those social skills of communication that are involved in accepting, clarifying, and making use of the ideas and feelings of students. The indirect teachers have these skills, even though they are not in use a major proportion of the time. Although they are used sparingly, they are essential when needed.

Associated with this increased social skill is less need for directions and criticism. When the most direct are compared with the most indirect, the proportion of giving directions is two-to-one and for criticism the contrast increases to eight-to-one. These figures are consistent with what has been said about dependence. Lack of clarifying and using student ideas places the teacher in a position of giving more direction, in short, he must work harder to keep his students successfully working. When dependence is higher, progress by students depends much more on continuous teacher supervision.

There are interesting comparisons, here, between what we have found and some of the more common criticisms of the public schools that have attained national prominence during the last two years. Some critics of the public schools have advocated that teachers "get tough," tell students what to do and demand high standards. Our data show that higher standards can be achieved not by telling students what to do in some sort of misguided "get tough" policy, but by asking questions and then using student ideas, perceptions and reactions to build toward greater self direction, student responsibility and understanding. If "getting tough" means helping students face the consequences of their own ideas and opinions, contrasted against living with the consequences of the teacher's ideas and opinions, then our indirect teachers are much tougher.

The third implication for classroom teachers we would like to mention is that variability in teacher influence, what we have called flexibility, is associated with teachers whose students learned the most. One consequence of this finding is that our better teachers were less alike and our poorer teachers were more alike. It suggests that creative teaching is an expression of a particular teacher's personality, working with a particular group of students, in a particular subject matter field.

We should emphasize again that our six most indirect social studies teachers fell clearly into two types. Three lectured much more and placed greater emphasis on content material, but all six shared the common characteristic of a higher I/D ratio. The more content oriented teachers worked with student ideas less, but when they did, their pattern was essentially indirect. The other three teachers worked in a very different style that included 31.6 per cent student talk, the highest average in the entire study. The average student achievement of this latter group was a non-significant one-half point higher, indicating that achievement was high for two rather different styles of teaching. It also indicates that a variation from 20 per cent student talk in the content oriented style to 31.6 per cent student talk in the other three classrooms is not associated with a significant difference in achievement.

One way to interpret the differences between the direct and indirect teachers is in terms of the different roles the teacher is able to play in the classroom. The direct teachers could not shift their style of interaction as much as the indirect teachers. In effect, the direct teachers had fewer ways of working with students, they could provide only a limited number of roles. On the other hand, the indirect teachers were capable of providing many different roles and they shifted their role in a manner consistent with the theories that have already been stated.

Implications for pre-service and inservice education:--There is no substitute for knowledge of what is being taught. Two of the mathematics teachers were not adequately trained. One of these two classes showed an average mean gain in achievement that was one-sixteenth of the mean gain of the highest class and was last in rank order. The other class was number nine in rank order. The teacher of this latter class used more social skill in guiding classroom communication. He acted as if his attitude was, "I'm no math teacher, but we'll have to make the best of it and learn this material together." His class exceeded the achievement of one or two other classes whose teachers were much better qualified in so far as mathematics training was concerned, yet his class achievement could not match that which occurred in classrooms in which the teacher was both socially skillful and qualified.

The two cases just described illustrate a general implication of this project for the training of teachers. Teachers who are qualified in some content area should be exposed to some type of human relations training that will help them attain the following objectives: first, the ability to use the social skills of accepting, clarifying, and using the ideas of students in planning work and diagnosing difficulties; second, knowledge of those acts of influence that restrict student reactions and those that expand student reactions; and third, understanding of a theory of instruction that he can use to control his own behavior as he guides classroom communication.

It seems reasonable to suppose that these objectives cannot be reached without supervised practice. The person supervising this practice should be able to provide the practice-teacher with information about his own behavior. One way to do this is to use the technique of interaction analysis. The procedure is likely to involve threat for the practice-teacher and will require a skillful, indirect approach on the part of the supervisor.

A proper training procedure would permit practice-teachers to try out different patterns of influence. Suppose on one occasion the practice teacher wanted to try introducing some material with a highly direct pattern. On another occasion he tried an indirect pattern. A qualified observer could collect interaction analysis data, tabulate the two matrices, and discuss the resulting communication patterns with the practice-teacher. This could be done by training all practice-teachers to become reliable observers and then, in teams of two, they could alternate the roles of observer and teacher.

Implications for merit pay:--In the coming decade of the sixties, the issue of some kind of merit pay for gifted teachers will receive more and more attention. Already many school districts are experimenting with different systems. Since this study deals with teacher effectiveness, inferences about the merit pay issue are inescapable.

Two warnings should be issued to anyone who reads this project report and then makes inferences about merit pay. The first warning is that it is easier to identify poor teaching than it is to identify good teaching. The teachers in this study whose students learned the least and who had the poorest attitudes toward the teacher and class activities were quite similar. The teachers who presented the opposite picture were more flexible. Using the research technique of this project, no reliable distinctions between teachers could be made concerning how much the students talked, how the teachers used their time, and the distinction between the eight and nine categories of student talk (i.e., student response versus student initiation.) The possibility of making such distinctions with the further refinement of our techniques looks promising, but much more preliminary work will be necessary.

The second warning is that the correlations between various measures derived from interaction analysis, student attitude inventories, and tests of achievement, are still so low that individual teacher evaluation is subject to considerable error even though the general trends of the research are statistically significant. So much for the warnings.

The major aim of all systems of merit pay is to reward competence in such a way that all teachers who can will improve in their ability to teach. A secondary objective, which is to give higher pay for more difficult jobs, must await a more dramatic modification of school organization leading to specialized teaching functions. After working as closely as we have with the analysis of teacher-pupil contacts, our staff has developed a number of basic beliefs about some of the issues of merit pay that will now be expressed.

First, programs for the improvement of instruction should be designed and controlled by teachers as part of their professional responsibility. Teacher control, rather than administrative control, is necessary because changing one's methods of teaching is very personal, often involves emotional adjustments, cannot be coerced by administrative fiat, and therefore must be a voluntary, self-directed process.

Second, no system of teacher evaluation will be accepted by teachers until it has been tested and found satisfactory by the teachers whose professional welfare will be affected. Teachers must have confidence in the methods, criteria, and control before they will cooperate.

Third, it is our hunch that a system of inservice training that teachers think is successful in helping improve their own ability to teach can become, with care, a stepping stone to a satisfactory system of rewarding the exceptionally competent. In our opinion, this means that merit pay would normally follow a four to six year active, voluntary inservice training program that the majority of teachers feel has been successful. That is, as teachers experience success in improving their teaching and develop confidence in the criteria used to identify improvement, they will also be closer to accepting a system that provides monetary reward for those who make the most progress.

It is our opinion that whenever systems of merit pay are forced from "the top down" that the program will fail to meet its major objectives. Administrators and school boards following this path will meet with failure. In the same breath, it can be predicted that teachers who resist efforts to improve instruction, refuse to alter policies of single salary schedules that have served well in the past, will be confronted with increasing criticism from the public and from school board members. Sooner or later the minimum teachers' salary will stop improving in relation to the general economy, then it will be in the best interests of the profession to raise the ceiling of teacher income for those who are most qualified and most effective.

If one can accept the foregoing assertions, it follows that it is a professional responsibility to develop objective criteria and procedures that evaluate teacher effectiveness. The most rugged test of any procedure is an objective research program that not only provides evidence of the highest quality attainable, but also employs procedures that nearly all teachers can understand and use in a self improvement program.

The implications of interaction analysis:--The system of interaction analysis used in this study is content free. It is concerned primarily with the social skills of classroom management expressed through verbal communication. It is costly, cumbersome, and requires some form of automation in collecting, tabulating and analyzing the raw data. It is not yet a finished research tool.

Nevertheless, our staff has experienced minor triumphs that we will never forget. We have, for instance, played the following game with considerable success. A single observer collects interaction analysis data, tabulates a matrix, and presents the matrix at a staff meeting. The only information supplied to the staff is the presumed objective of the lesson, the grade level, and the sex of the teacher. The observer who collected the data remains silent as the rest of the staff reconstructs the social interaction. Conclusions about the tempo or speed of interaction, the relative domination of the teacher, whether he asks long or short questions, how much he lectures, and many other aspects of the interaction are listed. After the group has finished crawling out on the end of the limb, the observer who was present when the data were collected corrects any misconceptions that may have developed. The number of correct speculations is usually very high, well over 80 per cent. Occasionally a single misconception colors other guesses until a picture develops that is quite incorrect. These latter outcomes are remarkably infrequent. (See p. 23, Appendix F.)

Much of the inferential power of this system of interaction analysis comes from tabulating the data as sequence pairs in a 10 X 10 matrix. This is a time consuming process. It can be and should be done mechanically by special equipment, I.B.M., or electronic computers. When the high cost of tedious tabulation is under control, there remains the problem of training reliable observers and maintaining their reliability.

The potential of this research tool for a wide application to problems in education remains to be explored. So far, we have reason to be optimistic about its value.

3

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APPENDIX A, PAGE 1
First Year Social
Studies Test

Social Studies Unit
Part I

Directions: For the following questions write the letter which is in front of the best answer on the blank space before the number of the question.

____ 1. The word "climate" usually refers to (a) temperature, (b) rainfall, (c) wind conditions, (d) weather in general.

____ 2. People are most likely to settle first (a) on a plain, (b) on a desert, (c) on a lake, (d) in the mountains.

____ 3. Before the discovery of America, most trade between countries was carried on by (a) water, (b) land, (c) air.

____ 4. Most trade between countries today is carried on by (a) water, (b) land, (c) air.

____ 5. During the colonial period in America, travel to the western part of the country was made easier by the (a) highways, (b) railroads, (c) rivers, (d) canals.

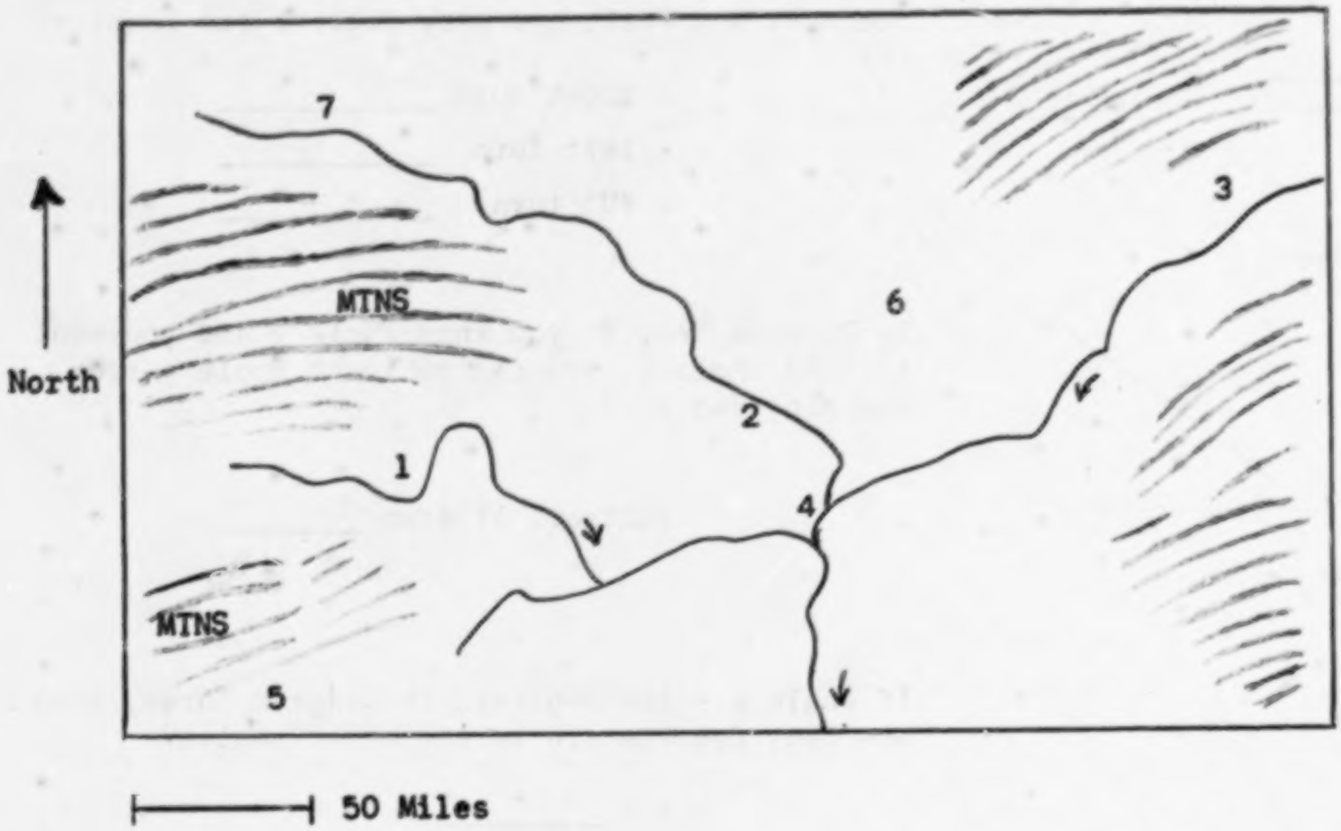
____ 6. Greenland is almost uninhabited because it is so (a) hot, (b) cold, (c) wet, (d) dry.

____ 7. St. Louis is located at the point where the Mississippi River joins the (a) Missouri River, (b) Ohio River, (c) Red River, (d) Wabash river.

____ 8. Most of the great cities of the world are located (a) near the center of countries, (b) along the seacoast, (c) in places where they would be easy to defend, (d) near rich farm land.

____ 9. The population along the Amazon River in South America is relatively low because of the (a) poor soil conditions, (b) poor climate, (c) poor transportation, (d) unsettled political conditions.

____10. Most of the people of the world are engaged in (a) agriculture, (b) commerce, (c) industry, (d) mining.



Part II

Directions: The above map shows an imaginary section of a country in about the same latitude as northern United States. During the winter the prevailing winds come from the west and are very cold. During the summer the winds are hot and from the south. The numbers, 1 to 7, mark the location of imaginary cities. On the basis of what you can see on the map, answer the following questions by writing the letter which is in front of the best answer on the blank space before the number of the question.

___11. The most likely cause for the decline of city No. 4, and the growth of cities 1,2,3, and 6, would be a change in (a) transportation, (b) occupations of the people, (c) climate.

___12. If city 4 were the largest, we could expect a slow increase in the population of city 4, and a rapid growth of the population in cities 1,2, and 3 during a period of (a) industrial development, (b) exploration, (c) westward expansion, (d) political unrest.

___13. If city 5 suddenly started to grow rapidly, the growth would most likely have been caused by a change in (a) climate of the region, (b) transportation, (c) occupations.

___14. The growth of city 7 would most probably be related to (a) climate, (b) transportation, (c) occupation.

___15. If exploration of this region took place from west to east, the most likely location for a large city would be at (a) 1, (b) 2, (c) 3, (d) 4.

1.

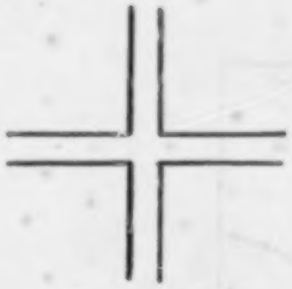


Diagram One

If you approach the intersection in Diagram One at which the streets are due north and south and due east and west, how many degrees are involved in:

a right turn ____________

a left turn ____________

a "U" turn ____________

2.

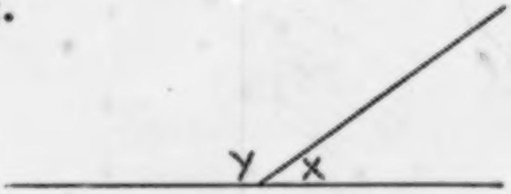


Diagram Two

In Diagram Two, if you know angle y and you want to find angle x, you can subtract angle y from how many degrees?

subtract it from ________

3.

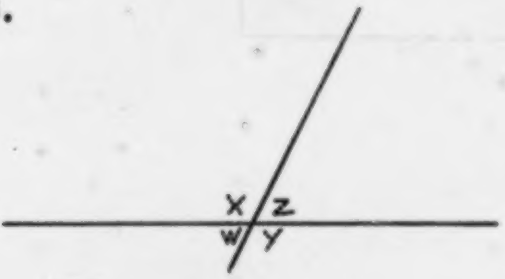


Diagram Three

If angle x = 110 degrees, in Diagram Three, then how many degrees are in the other angles?

z = ________

y = ________

w = ________

4.

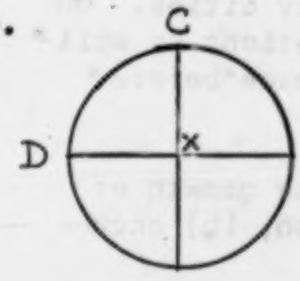


Diagram Four

In Diagram Four, if the angle "x" = 90 degrees, how many degrees are there in the arc, or section of the circle labelled "C - D"?

Arc "C - D" = ________

5.

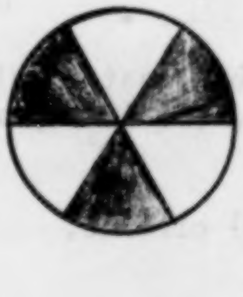


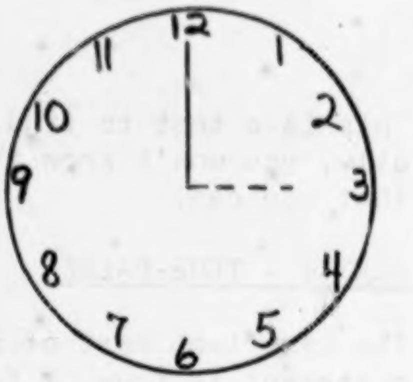
Diagram Five

Suppose you had to paint a wheel in two colors like the one in Diagram Five for a stage play. If all of the angles at the center are equal, what is the size of each angle? If the wheel is 10 inches in diameter, approximately how many inches of rubber strip would you need to cover the rim with a tread?

angles at the center = ________

inches of rubber = ________

6. **Mr. Smith, the town clock-maker, has been commissioned to build a large clock for the city hall tower. He must know what angles the clock hands make at different times.**



   a. **What angle will the hands make at 3:00?**

   ________ **degrees**

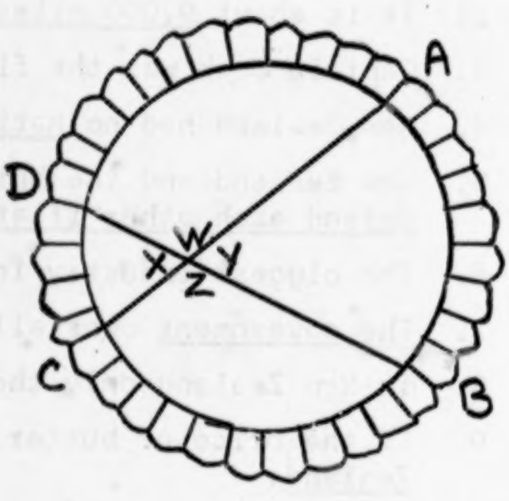
   b. **What angle will the hands make at 8:00?**

   ________ **degrees**

   c. **What angle will the hands make at 5:00?**

   ________ **degrees**

7. **Suppose you were at a circular fountain in Rome, Italy, which had 36 equal sized stones around its edge. You and your three friends stood at positions A, B, C, and D. If you pulled a string tight between each pair, as shown, what angles would be formed?**



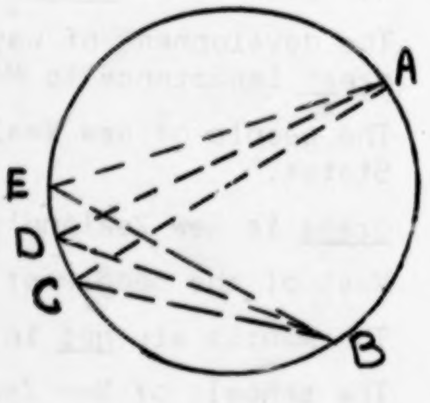
angle x ________ **angle y** ________

angle w ________ **angle z** ________

If you wanted to prove your answers are correct, the four angles should total how many degrees?

total degrees ________

8. **A man set up camp, one night, on the shore of Perfect Circle Lake at point A. He decided he would try to estimate the diameter of the lake or the distance across it in miles. So the next morning he carefully paced off one mile to point B where he piled up several stones for a marker. He continued in the same direction, pausing at points C, D, and E to estimate the angle between his marker (B) and his camp (A). His estimates at each point were close to 30 degrees. What is the diameter of the lake?**



________ **miles**

TEST ON NEW ZEALAND
PARTS I-IV

This is a test to find out how much students know about New Zealand. Naturally, you won't know the answers to some of the questions, but do the best that you can.

PART I - TRUE-FALSE

The important part of each statement is underlined. Decide whether each statement is true or false. Then mark your answer sheet like this:

> If it is true cross out the "T" for that number on the answer sheet.
> If it is false cross out the "F" for that number on the answer sheet.

1. New Zealand is north of the equator.
2. It is about 9,000 miles from San Francisco to New Zealand.
3. Captain Cook was the first white man to explore New Zealand.
4. New Zealand had no native animals.
5. New Zealand and the United States have mutual defense treaties to help defend each other if attacked.
6. The biggest industry in New Zealand is sheep raising.
7. The government owns all factories in New Zealand.
8. In New Zealand only the government may sell butter to other countries.
9. If the price of butter went down in Great Britain this would help New Zealand.
10. Rivers in New Zealand are good for transportation.
11. New Zealand has plenty of rain.
12. New Zealand has had several unusual types of wild life.
13. New Zealand is short of water power.
14. The development of ways of refrigerating meat and dairy products was of great importance to New Zealand.
15. The people of New Zealand are not as healthy as the people of the United States.
16. Grass is New Zealand's most important crop.
17. Most of the people of New Zealand live on farms.
18. The Maoris are not in the government of New Zealand.
19. The schools of New Zealand are run by town school boards.
20. More than two political parties have members in the House of Representatives of New Zealand.
21. Most (over two-thirds) of the people in New Zealand vote in elections.
22. New Zealand has free public schools for all children.

PART II - MULTIPLE CHOICE

Choose the best answer and cross out that letter on the answer sheet.

Example: 0. What is New Zealand?
A) A colony
B) A state in a country
C) A country
D) A part of the Dutch empire

Since "C" is the best answer, you would cross out C on your answer sheet like this:

0. A B ~~C~~ D

1. Forests at one time covered half of New Zealand. Which of the following destroyed most of New Zealand's forests?
A) The Maoris burned them
B) They were killed by insects from other countries
C) They were cut down to make Maori canoes
D) They were cleared and burned to make way for farming
E) Disease killed most of the trees

2. The chief occupation of New Zealand is:
A) Raising grain crops
B) Manufacturing
C) Lumbering
D) Butter making
E) Animal raising

3. New Zealand has which of the following kinds of weather?
A) Hot, dry summers and cold, wet winters
B) Hot and heavy rainfall all year around
C) Hot and dry all year
D) Mild temperatures with fairly heavy rainfall all year around
E) Long cold winters, short cool summers with light rainfall

4. There are three products which New Zealand exports more of than any other country.
A) Wool, mutton and beef.
B) Eggs, milk and beef
C) Wool, cotton and flax
D) Butter, beef and cheese
E) Mutton, cheese and butter

5. New Zealand is located between which of the following?
A) Between Australia and South America
B) Between Australia and Asia
C) Between South America and Africa
D) Between Australia and the South Pole
E) In the Indian Ocean between Asia and the South Pole

6. New Zealand is able to buy what it needs from other countries chiefly because it
   - A) Exports gold
   - B) Has a large tourist industry
   - C) Exports manufactured goods
   - D) Has a large shipping industry
   - E) Exports farm products

7. The United States is only half as far from New Zealand as Great Britain is. Why does New Zealand have less trade with the U.S. than with Great Britain?
   - A) Great Britain is friendlier
   - B) Great Britain produces goods which New Zealanders prefer
   - C) New Zealand is able to sell farm products to Great Britain
   - D) The United States does not have what New Zealand needs to buy
   - E) New Zealand has always bought most of what it needs from Great Britain

8. What was the most important effect of the coming of the British upon the Maoris?
   - A) It improved their health by modern medicine
   - B) The Maoris were pleased to be able to trade for tools and weapons
   - C) The Maoris' whole system of life was upset
   - D) The Maoris' way of life improved because of the things which they could get from the British
   - E) The Maoris were pleased to have a government set up to rule over them and help to end their tribal wars

9. How is the government of New Zealand run?
   - A) New Zealand has to obey decisions of Queen Elizabeth
   - B) New Zealand governs herself except in relations with other countries
   - C) New Zealand is governed by the Parliament of Great Britain
   - D) New Zealand governs herself through its own House of Representatives
   - E) New Zealand is governed in the same way as any other colony in the British Commonwealth of Nations

10. When it is winter in Minneapolis, what season is it in New Zealand?
    - A) Winter
    - B) Spring
    - C) Summer
    - D) Fall

11. New Zealand is
    - A) In monsoon Asia
    - B) In Southeast Asia
    - C) In the tropics
    - D) In the middle South Latitudes
    - E) In the middle latitudes

12. Why are most of the cities of the South Island on the east coast and not on the west coast?
    - A) It is nearer England
    - B) The west coast is too mountainous
    - C) There are too many sheep on the west coast
    - D) The rivers are on the east coast
    - E) Electric power is available on the east coast

13. Where are people most likely to settle first?
    A) On a plain
    B) On a desert
    C) In the highlands
    D) In the mountains

14. During the period of settlement travel in New Zealand was mainly by
    A) Road
    B) Railroad
    C) Ocean
    D) River

15. Which of the following is not a big industry in New Zealand?
    A) Meat processing and freezing
    B) Ship building
    C) Forestry products
    D) Cheese making
    E) Butter making

16. Which of the following is not imported (brought into) New Zealand in large amounts?
    A) Meat products
    B) Textiles
    C) Machinery
    D) Cars and trucks
    E) Oil and gasoline

17. Why does New Zealand import most of its automobiles and machinery?
    A) It wants to help Britain
    B) It likes British automobiles and machinery
    C) New Zealanders don't know how to make these things
    D) It lacks the fuel to run factories to make these products
    E) It lacks the iron to make these products

18. The population of New Zealand is about
    A) 1,000,000
    B) 2,000,000
    C) 3,000,000
    D) 5,000,000
    E) 20,000,000

19. The size of New Zealand is about the same as
    A) Australia (about 3,000,000 sq. miles)
    B) Minnesota (about 80,000 sq. miles)
    C) The United States (about 3,600,000 sq. miles)
    D) Colorado (about 100,000 sq. miles)

20. New Zealand was not discovered until about 1640 because
    A) It was not on the route to any other country
    B) There was nothing valuable for trade there
    C) Europeans were not interested in finding any more new lands
    D) It was too far north

21. Which of the following things happened because of the development of refrigeration?
    - A) Small farms became profitable
    - B) Meat and dairy products could be shipped overseas
    - C) Sheep raising increased
    - D) More people could make a living in New Zealand
    - E) All of the above

22. Which of the following describes the relationship between the British and the Maoris?
    - A) The Maoris accepted the British rule by signing a treaty
    - B) The British government tried to protect the land of the Maoris
    - C) Many of the Maoris became Christians
    - D) Some Maoris fought fiercely to throw off British rule
    - E) All of the above

23. Which of the following correctly describes the Maoris?
    - A) A savage people who had no art
    - B) A people without laws or rules
    - C) All Maoris were equal to each other
    - D) A strong people who loved wars
    - E) All of the above

24. Which of these have the Maoris contributed to modern New Zealand?
    - A) Improved methods of warfare
    - B) A different system of government
    - C) The names of many places
    - D) All of the above
    - E) None of the above

PART III - MATCHING

Mark the letter on your answer sheet which shows what the words below mean.

1. Prevailing winds
2. Temperate zone
3. Sub-tropical

A) A hot, moist climate

B) The usual direction

C) The opposite side of the world

D) A mild climate

E) The usual total amount of rain

PART IV.

1. Using the map on the right, what is the latitude and longitude of Auckland?

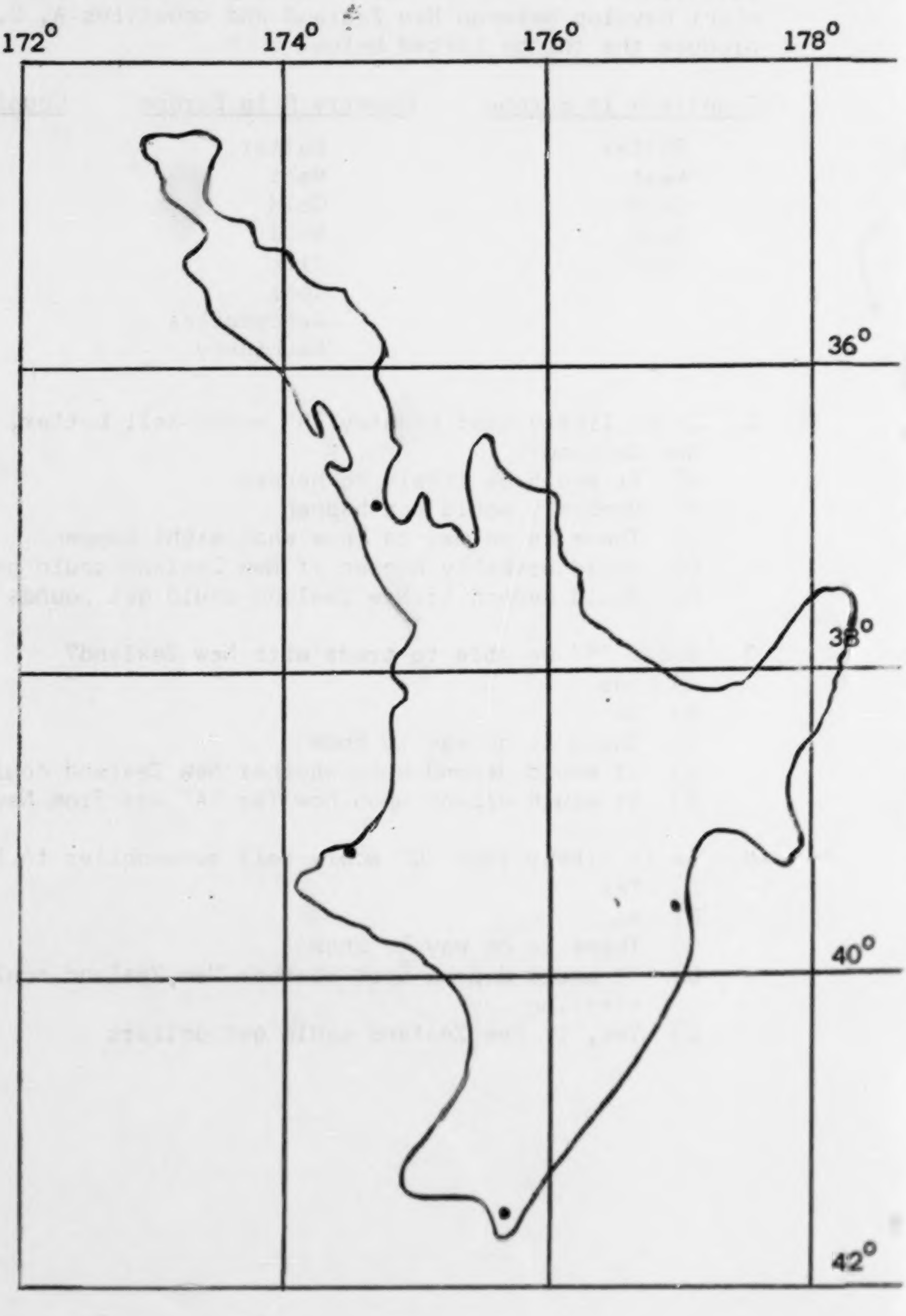
A) 39°S, 175°E

B) 36°25'S, 175°E

C) 36°25'S, 174°W

D) 39°S, 174°W

E) 39°45'S, 177°E


172°
174°
176°
178°
36°
38°
40°
42°

Question 2 - 4: Answer the following questions about what trade relations might develop between New Zealand and countries A, B, and C. The countries produce the things listed below.

Country A in Europe	Country B in Europe	Country C in North America
Butter	Butter	Wood
Meat	Meat	Iron
Gold	Gold	Coal
Wood	Wood	Automobiles
Coal	Iron	Machinery
	Coal	
	Automobiles	
	Machinery	

2. Is it likely that country "B" would sell butter, meat and gold to New Zealand?
   A) It would be likely to happen
   B) Probably would not happen
   C) There is no way to know what might happen
   D) Would probably happen if New Zealand could get more dollars
   E) Would happen if New Zealand could get pounds sterling

3. Would "A" be able to trade with New Zealand?
   A) Yes
   B) No
   C) There is no way to know
   D) It would depend upon whether New Zealand could get more dollars
   E) It would depend upon how far "A" was from New Zealand

4. Is it likely that "C" would sell automobiles to New Zealand?
   A) Yes
   B) No
   C) There is no way to know
   D) It would depend upon whether New Zealand could get more pounds sterling
   E) Yes, if New Zealand could get dollars

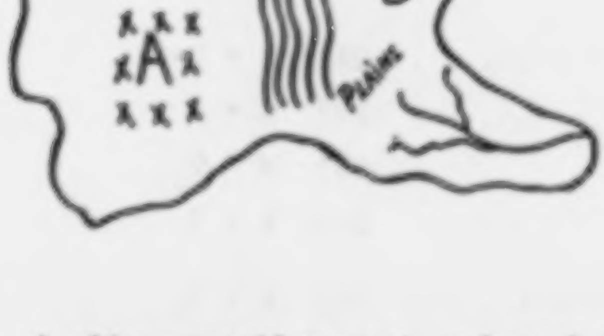
Questions 5 and 6: If countries D, E, and F have the following resources, what industries may develop?

Country D	Country E	Country F
Plenty of water power	Some water power	Very little water power
Very little iron	Plenty of iron	Good farm land
A fair amount of coal	Plenty of coal	Close to other countries
Plenty of good farm land	Some good farm land	Not many people
Is a long way from other countries	Is close to other countries	Some iron
Not many people	Has many people	

5. Which country is most likely to develop factories to make cars, trucks, and cloth?
   - A) In country "D"
   - B) In country "E"
   - C) In country "F"
   - D) In both countries "D" and "E"
   - E) In all three countries

6. Which country is most likely to raise extra food
   - A) In country "D"
   - B) In country "E"
   - C) In country "F"
   - D) In both countries "D" and "E"
   - E) In both countries "D" and "F"

Questions 7 through 10: Use this map to answer the questions below



This is a map of an imaginary country. It is in the same latitude as New Zealand in the Pacific Ocean. A, B, C, D, and E are imaginary places. Decide where the activities described below would be likely to take place. Would it be at A, B, C, D, or E. Use each answer only once.

KEY

▨ Humid jungle

X High mountains

≋ Fairly rough highlands

7. A city exporting meat and wool to other countries

8. A mining town

9. Dairy farms producing milk and butter

10. Sheep farming

MATHEMATICS TEST

Section A:--In this section solve each equation to find the value of the unknown. Place your answer sheet opposite the problems and write your answers in the boxes provided on the answer sheet. DO NOT WRITE ON THIS TEST PAPER. Use some spare paper to do any figuring.

1) $2x = 8$ $x = ?$
2) $10R = 50$ $R = ?$
3) $25K = 25$ $K = ?$
4) $9Y = 3$ $Y = ?$
5) $5 = 10X$ $X = ?$
6) $\frac{N}{9} = 5$ $N = ?$
7) $\frac{K}{3} = 10$ $K = ?$
8) $\frac{2M}{3} = 20$ $M = ?$
9) $.6R = 3$ $R = ?$
10) $X + 5 = 7$ $X = ?$
11) $3K + 10 = 40$ $K = ?$
12) $35 + Y = 37$ $Y = ?$
13) $E + 1.2 = 2.4$ $E = ?$
14) $K - 9 = 11$ $K = ?$
15) $X - 6 = 12$ $X = ?$
16) $2X - 8 = 0$ $X = ?$
17) $3A - 4 = 5$ $A = ?$
18) $3X - 2 + 4X = 12$ $X = ?$
19) $7F - 1 = 29 + F$ $F = ?$
20) $7C - 9 = 15 - C$ $C = ?$
21) $\frac{3}{4}P + \frac{1}{2} = 2$ $P = ?$
22) $6Q - \frac{2}{3} - \frac{Q}{2} - 3 = 0$ $Q = ?$

Section B:--Follow the directions in each problem. Be sure you write your answer in the box that has THE SAME number as the problem on this sheet.

Suppose you are given the equation --

$A = B$ then, ... 23) $A - 6 = ?$
24) $3A - 2 = ?$
25) $A - B = ?$

Suppose you are given the equation --

$\frac{N}{K} = \frac{W}{E}$ then, ... 26) $N = ?$
27) $K = ?$
28) $W = ?$
29) $E = ?$

If $3X + 2Y = 10$, and $Y = 2$, then. . . . . 30) $X = ?$

If $2R - 3T - 5 = 0$, and $T = 3$, then . . . . 31) $R = ?$

If $\frac{6X - 3}{Q} = 9$, and $Q = 3$, then . . . . 32) $X = ?$

Section C:--Here are some questions about angles and arcs. Continue with the same answer sheet.

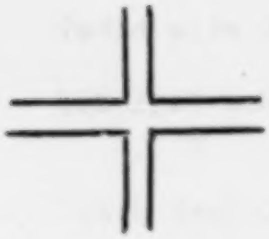


Fig. 1

If you approach the intersection in Figure 1 at which the streets are due north and south and east and west, how many degrees are involved in a --

33) a right turn?

34) a left turn?

35) a "U" turn?

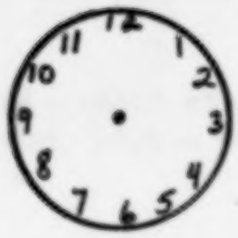


Fig. 2

In Figure 2,--

36) What angle will the hands make at exactly 11 o'clock?

37) What angle will the hands make at exactly 2 o'clock?

38) What angle will the hands make at exactly 5 o'clock?

39) Through what angle will the minute hand rotate from 12 o'clock to 12:35?

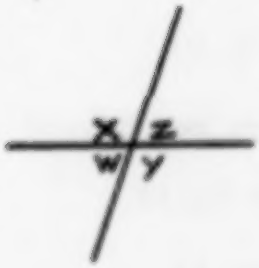


Fig. 3

In Figure 3,--

40) If you know $\angle x$ and you want to find $\angle z$, you can subtract x from how many degrees?

41) If you add $\angle x + \angle z + \angle y + \angle w$ together, they will add to what total?

42) If $\angle x$ = 110 degrees, then $\angle z$ = ?

43) If $\angle x$ = 110 degrees, then $\angle y$ = ?

44) If $\angle x$ = 110 degrees, then $\angle w$ = ?

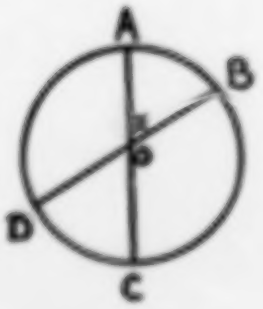


Fig. 4

In Figure 4, "O" is at the center of the circle and $\angle x$ = 60 degrees.

45) How many degrees are in $\overset{\frown}{DC}$?

46) How many degrees are in $\overset{\frown}{BC}$?

47) If you add the arcs $\overset{\frown}{AB} + \overset{\frown}{BC} + \overset{\frown}{CD} + \overset{\frown}{DA}$, what will be the total?

Section D:--In this section there are some word problems. Write your answers in the boxes provided on the answer sheet; do any figuring on a spare piece of paper.

48) A speed boat goes 20 m.p.h. for $2\frac{1}{2}$ hours. How far did it travel?

49) Bill walks 6 m.p.h. How long will it take him to finish a 20 mile hike?

50) Sally rides her bicycle 6 miles into town in $\frac{2}{3}$ of an hour. How fast did she ride?

51) What length of ribbon will you need to go exactly around a 10 inch diameter ball with no overlap?

52) What is the ratio of the circumference of any circle to its diameter?

53) If an airplane travels at 314 mph. in a circle 10 miles in diameter, how many circles can it make in 30 minutes?

54) Jim and Bill start to walk toward each other's house at the same time. The houses are 5 miles apart. Bill walks 6 m.p.h. and Jim walks 4 m.p.h. How long before they will meet?

Section E:--This section will deal with correcting for inconsistent units. Indicate your answer by checking the right box on the answer sheet.

55) Bill walks 6 m.p.h. To change this to miles per minute you must--

a) multiply by 60

b) divide by 60

56) Bill can crawl at 6 feet per second. To change this to inches per second you must--

a) multiply by 12

b) divide by 12

57) How many feet will your car travel in $1\frac{1}{2}$ seconds at a speed of 70 m.p.h. Starting with D = R T, then D = 70($1\frac{1}{2}$), to get the correct answer you must--

a) divide by 5,280 and divide by 3,600

b) multiply by 5,280 and divide by 3,600

c) divide by 5,280 and multiply by 3,600

d) multiply by 5,280 and multiply by 3,600

Section F:--These last problems require you to develop your own equations in order to solve for the unknown.

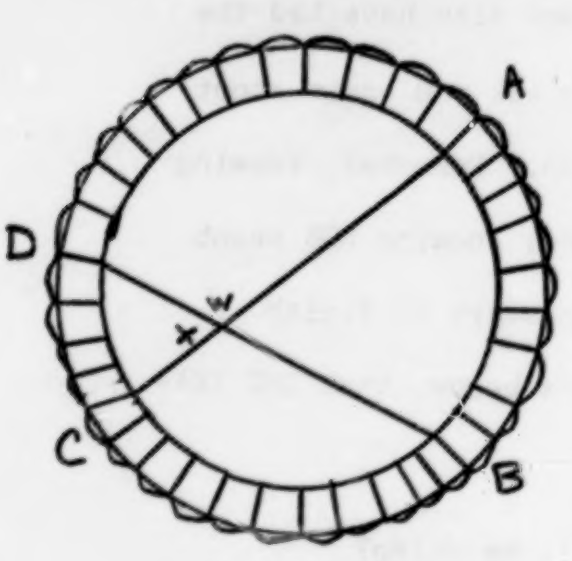


Fig. 5

In Figure 5, you and three friends stand at postions A, B, C and D around a fountain, let's say in Rome, Italy. The fountain has 36 equal sized stones around its edge. If you pulled a string tight between each pair of friends, as shown, what angles would be formed?

58) What is angle x?

59) What is angle W?

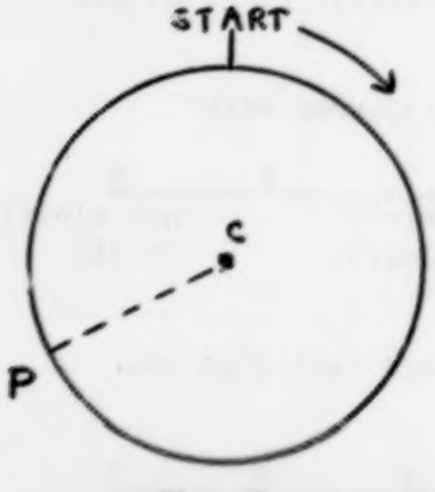


Fig. 6

Suppose you stand in the center of a circular race track, point C in Figure 6, watching an old car going 30 m.p.h. You decide to run from the center to point P which is two-thirds around the circle from the starting point to be at the edge of the track just as the car passes.

60) How fast must you run to get there just in time?

61) If you can run 10 m.p.h., at what central angle from the starting point should you run to just meet the car?

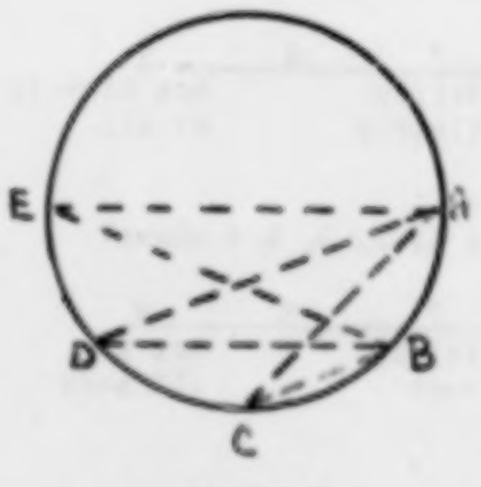


Fig. 7

A man set up camp one night on the shore of Perfect Circle Lake at point A, Figure 7. He decided he would try to estimate the diameter of the lake or the distance across it in miles. So the next morning he carefully paced off one mile to point B where he piled up several stones for a marker. He continued in the same direction, pausing at points C, D, and E to estimate the angle between his marker (B) and his camp (A). His estimates at each point were close to 20 degrees.

62) What is the diameter of the lake?

QUESTIONNAIRE

Now that you have heard the tape recording and also have had the chance to talk with the teacher, we would like to ask you again about how clearly you see the problems you might work on. Remember, knowing WHAT means that you can tell when you are finished; knowing HOW means that you can start and complete all the steps necessary to finish.

Again, pretend, when you answer the questions below, that THE TEACHER CANNOT HELP YOU.

1. RIGHT NOW how clearly do you see WHAT you will be doing?

1	2	3	4	5	6	7	8	9
very clearly						fairly clearly		not clearly at all

2. RIGHT NOW do you know clearly HOW to go about doing your work?

1	2	3	4	5	6	7	8	9
very clearly						fairly clearly		not clearly at all

3. Can you picture your work so clearly that you could tell when you will be finished?

1	2	3	4	5	6	7	8	9
very clearly						fairly clearly		not clearly at all

4. Can you see ALL the steps necessary to finish the schoolwork?

1	2	3	4	5	6	7	8	9
very clearly						fairly clearly		not clearly at all

5. How sure are you about your answers to questions 1, 2, 3, & 4 above?

1	2	3	4	5	6	7	8	9
very sure						fairly sure		not at all sure

QUESTIONNAIRE

Any student starting to do schoolwork must know at least two things in order to work effectively. First, he must know enough about what he is doing so that he can tell when he is finished. Second, he must have a plan, not only to get started, but a plan for each step that is required to get the job done. Remember these two questions. WHAT am I trying to do? HOW will I go about doing it? If you do not know WHAT and HOW, then you are not ready to go to work. Instead, it would be necessary to make better plans.

When you answer the questions below, pretend that the teacher cannot help you get started because he is either too busy or out of the room.

1. How clearly does the tape recording tell you WHAT you will be doing?

1	2	3	4	5	6	7	8	9
very clearly						fairly clearly		not clearly at all

2. How clearly does the tape recording tell you HOW to go about the job?

1	2	3	4	5	6	7	8	9
very clearly						fairly clearly		not clearly at all

3. Can you picture your work so clearly that you could tell when you finished the job?

1	2	3	4	5	6	7	8	9
very clearly						fairly clearly		not clearly at all

4. Can you see ALL of the steps necessary to finish the job?

1	2	3	4	5	6	7	8	9
very clearly						fairly clearly		not clearly at all

5. How sure are you about your answers to questions 1, 2, 3, and 4?

1	2	3	4	5	6	7	8	9
very sure						fairly sure		not sure at all

* * *

NOW SUPPOSE THE TEACHER CAME BACK INTO THE ROOM OR WAS IN A POSITION TO HELP YOU.

1. How much help would you like from the teacher when you go to work?

1	2	3	4	5	6	7	8	9
no help		very little		a little		a fair amount		much help

2. Would you do better working with another student?

1	2	3	4	5	6	7	8	9
not at all		maybe		a little		a fair amount		quite a bit

3. How often would it be wise to show your work to the teacher to be sure that you are on the right track?

1	2	3	4	5	6	7	8	9
not at all		maybe once		just once		several times		as frequently as needed

APPENDIX B - CONTENTS

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First Year Mathematics Worksheet B-1

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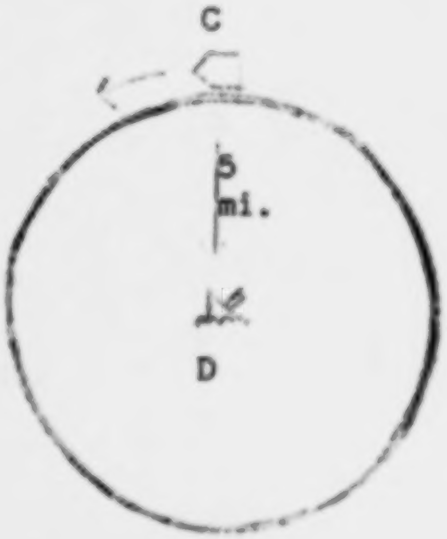
THE WHIRLY-BIRD AND THE FLAT TOP WORKSHEET



An aircraft carrier is circling around a destroyer that went aground on a reef and is breaking up in the surf. By staying exactly five miles away the carrier can avoid reefs; by steaming 30 miles per hour she can avoid enemy subs. Aboard the destroyer are 12 men who must be rescued.

A helicopter can fly 60 miles per hour from the carrier to the destroyer, it can hover for 6 minutes to pick up two men, fly back at the same speed, and take 4 minutes to land and unload the two men.

The first flight of the helicopter started when the carrier was due north of the destroyer; carrier at C, destroyer at D. Assume the helicopter flys in a straight line and the carrier steams in a perfect circle.

Remember: 60 miles per hour equals one mile per minute
speed (in miles per hour) X time (in hours) equals distance (in miles)
speed (in miles per minute) X time (in min.) equals distance (in miles)

_____ 1. How long does it take the helicopter to fly to the destroyer?

_____ 2. After leaving the carrier on the first trip, how many minutes later will the helicopter be taking off on its second trip?

_____ 3. When the helicopter leaves the destroyer with the first two men, how far, in miles, will the carrier have travelled from point C?

_____ 4. When the helicopter arrives at the carrier with the first two men, how far, in miles, will the carrier have travelled from point C?

_____ 5. During the 4 minutes that the helicopter is unloading the first two men, how far will the carrier travel in miles?

_____ 6. When the helicopter leaves the destroyer with its first two men and starts to fly back to the carrier, at what angle will it fly away from the destroyer compared with its arrival from due north? (Remember it must head toward the spot where it meets the carrier.)

_____ 7. When the helicopter arrives at the destroyer to pick up the 5th and 6th men, at what angle will it arrive compared with its first arrival from due north?

_____ 8. How many miles will the carrier have travelled when all the men from the destroyer are safe aboard her?

WORK PROJECTS FOR THE CONTENT OF MOA - GEOGRAPHY UNIT

Look over the following projects and number them in the order in which you would like to work on them. Put this number on the blank space in front of the project. After you have done this, begin working on the one you ranked first. You may raise your hand to get advice from the teacher whenever you think it is necessary. Do as many projects as you can.

_____ A. Set up a railroad system. Draw lines connecting the cities. Indicate which cities would be the first to be connected and why. Explain why rail traffic would be heaviest in certain sections.

_____ B. Outline a highway network. Draw lines connecting the cities. Tell which are connected first and why. Describe some of the troubles you might have with the road construction.

_____ C. Set up an airlines system. Draw lines connecting the cities involved. Explain why you set up your headquarters in a particular city. Point out where air travel would be heaviest.

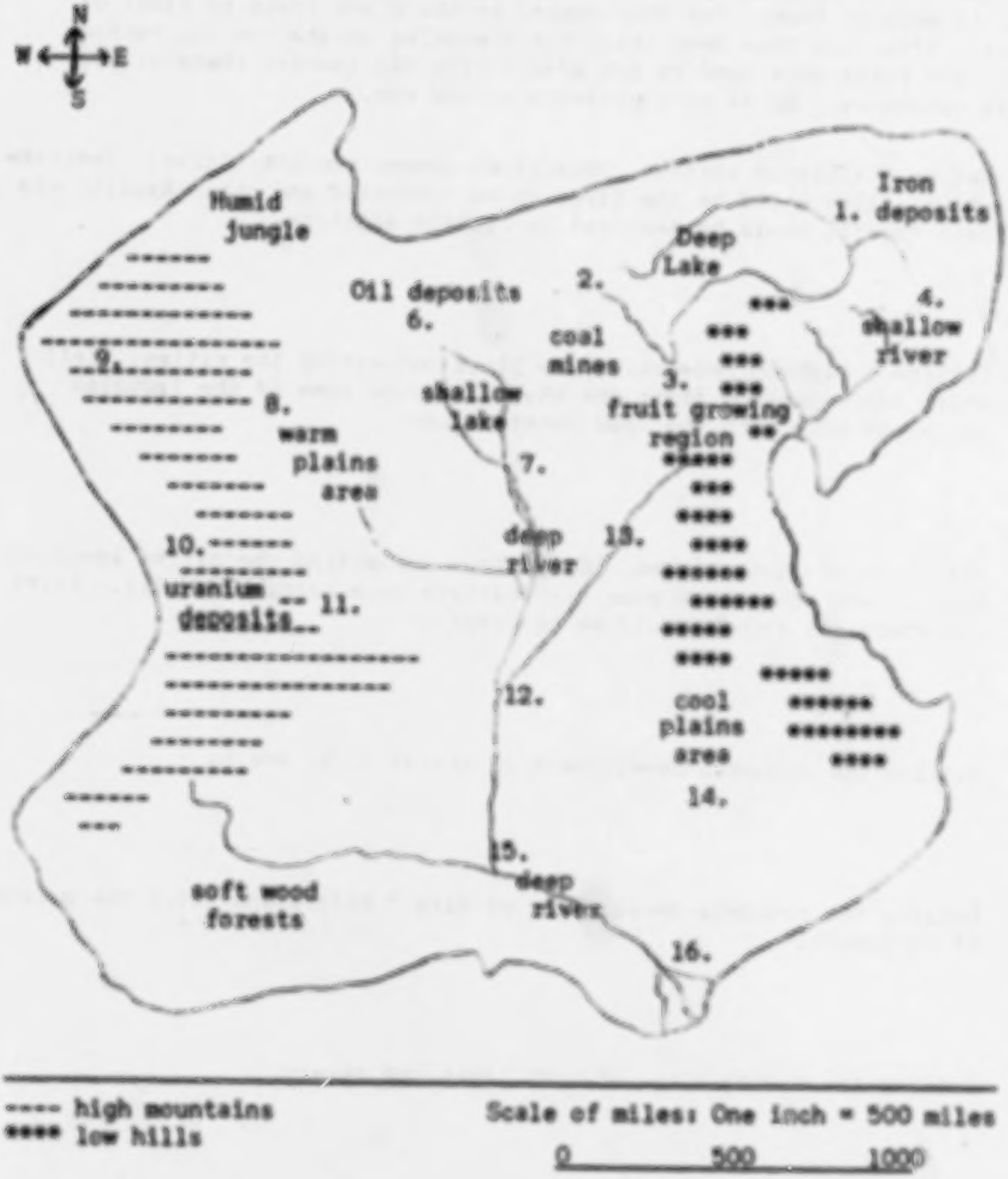
_____ D. Outline the economic development of cities 1, 2, and 6.

_____ E. Outline the possible development of city 7 before and after the growth of railroads.

_____ F. Outline the probable use of both lakes and rivers.

_____ G. As the head of an exploratory expedition - point out the cities you would select as your main bases and draw in the routes you would follow in an exploration of the country.

MOA - 1959


N
W
E
S
Iron
1. deposits
Deep
Lake
2.
4.
shallow
river
Humid
jungle
Oil deposits
6.
coal
mines
3.
fruit growing
region
shallow
lake
7.
9.
8.
warm
plains
area
10.
uranium
deposits
11.
deep
river
13.
12.
cool
plains
area
14.
15.
deep
river
soft wood
forests
16.
---- high mountains
•••• low hills
Scale of miles: One inch = 500 miles
0
500
1000

This is the imaginary continent of MOA which last week arose out of the Pacific Ocean, halfway between Australia and South America. It is approximately the same size as Australia and is in the same latitude. The numbers, 1 through 16, represent sixteen imaginary cities.

PROCEDURE FOR TESTING THE SIGNIFICANCE OF THE DIFFERENCE OF TWO MATRICES BY DARWIN'S METHOD*

Given two 11 x 11 matrices that are based on data collected in Flanders' categories, one can apply Darwin's test to determine the significance of the difference of these two matrices.

I. Preparation and reduction of matrices.

(1) Label the 11 cells of the title row and title column (starting with the second cell in each case) 1, 2, 3, 4, 5, 6, 7, 8, 9 10, and 11.

(2) Count the tally marks in each cell of the original matrix and place that number in the corresponding cell of the matrix you are preparing.

(3) Add all numbers in row 1 to get the row sum, and enter this number in the next cell to the right of row 1. Do this for each row. Title this column "Totals."

(4) Add all numbers in column 1 to get the column sum, and enter this number in the next cell below column 1. Do this for each column. Title this row "Totals."

(5) Add the row sums and column sums in turn as a check. These two numbers should be the same. If they aren't, you must go back and check your work to find your error(s). Enter the total in the cell where "totals" column crosses "totals" row. This is grand total for the matrix.

(6) Do steps (2) to (5) for both of the two matrices you are to test.

(7) Since Darwin's test is most accurate if each cell number is larger than 4 or 5, it is often necessary to reduce the matrices of step (6) to smaller matrices by combining corresponding cells.

---

*The procedure is identical for a 10 X 10 matrix. This procedure was extracted from an older study when we had eleven categories.

(8) Reduce the other matrix of (6) by the same procedure you used in (7) so that both are the same size (e.g., 9 x 9 and 9 x 9).

(9) Find all the row totals as in step (3) for your new matrices and enter them. Check the sums of corresponding rows and columns. You now have two matrices to which you can apply Darwin's test.

II. Computing Darwin's X^2 (chi square)

Darwin's test is described by the following formula:

$$2\left[\overset{\text{D.}}{\sum_{jk=1}^{n}(m_{jk})(\log_e m_{jk})} + \overset{\text{E.}}{\sum_{j,k=1}^{n}(n_{jk})(\log_e n_{jk})} - \overset{\text{F.}}{\sum_{j=1}^{n}(m_j)(\log_e m_j)}\right.$$

$$- \overset{\text{G.}}{\sum_{j=1}^{n}(n_j)(\log_e n_j)} - \overset{\text{H.}}{\sum_{j,k=1}^{n}(m_{jk}+n_{jk})\ \log_e(m_{jk}+n_{jk})}$$

$$\left.+ \overset{\text{I.}}{\sum_{j=1}^{n}(m_j+n_j)\ \log_e(m_j+n_j)}\right] = X^2$$

In words this says to solve:

$X^2 = 2\ [D + E - F - G - H + I]$ where the letters stand for the following procedures.

D) Multiply each cell number of the first matrix by its $\log_e$, and find the total of these 121 (or 81 etc.) numbers. This total is D.

E) Do the same as D for the second matrix.

F) Multiply each row sum of the first matrix by its $\log_e$, and find the total of these 11 (or 9 etc.) numbers. This total is F.

G) Do the same as F for the second matrix.

H) Prepare a third matrix by adding all the corresponding cells of the first and second matrices. Multiply each cell number of the third matrix by its $\log_e$, and find the total of these 121 (or 81 etc.) numbers. This total is H.

I) Multiply each row sum of the third matrix by its $\log_e$, and find the total of these 11 (or 9 etc.) numbers. This total is I.

III. Convert Darwin's X^2 to a standard score form $\frac{z}{\sigma}$ by use of the following formula:

$$\frac{z}{\sigma} = \sqrt{2(X^2)} - \sqrt{2n - 1}$$

where n equals the number of degrees of freedom and X^2 is Darwin's chi-square. In order to find n use the formula $n = y\ (y - 1)$ where y is the number of rows or columns in the matrix. For example, if it is a 9 x 9 matrix, $n = 9 \times 8 = 72$.

For a 1 per cent test of significance the results are significant if $\frac{z}{\sigma}$ is larger than 2.58 or 2.33, depending on whether the hypothesis is a two-tailed or one-tailed test, respectively.

Darwin's chi-square for the Geometry Group, 1st year experiments. Indirect vs. Direct Teacher Influence

Matrix A = Indirect
Matrix B = Direct
Matrix A + B = Combined Indirect and Direct

$$X^2 = 2\,[D + E - F - G - H + I] = 5935.0735 + 9201.4823$$
$$- 8007.4617 - 10861.1015 - 16055.6105 + 20138.7797$$
$$= 2\,[351.1618] = 702.3236.$$

$$\frac{z}{\sigma} = \sqrt{2(X^2)} - \sqrt{2n - 1} = \sqrt{2(702.3236)} - \sqrt{2(90) - 1}$$

$$= 24.10$$

STUDENT PERCEPTIONS OF TEACHER INFLUENCE

The questions below refer to the person acting as your teacher today. He is supposed to be acting in a particular kind of pattern. Please check on the blank space in front of the kind of behavior that you think is closest to that of the experimental teacher. CHECK ONLY ONE SPACE FOR EACH ITEM.

1. The teacher seems to be mostly concerned with

____ explaining the unit.
____ telling us what to do.
____ finding out what we know.
____ finding out what we want to do.

2. The attitude of the teacher seems to be

____ firm and businesslike.
____ relaxed and cheerful.
____ anxious and hurried.
____ good natured and easy to please.

3. He seems to want

____ to do most of the talking.
____ the students to do the talking.
____ us to make our own plans.
____ to make our plans for us.

4. His reactions to our ideas seem to be

____ critical.
____ complimentary.
____ that they aren't very useful.
____ that they are worth developing.

On the following items circle the number that best represents your opinion.

5. Does this teacher talk more than the students?

1 2 3 4 5 6 7 8 9
a lot more — about the same — less than the students

6. How often does the teacher use students' suggestions and ideas?

1 2 3 4 5 6 7 8 9
not at all — about half the time — all the time

7. How often does the teacher criticize the students?

1	2	3	4	5	6	7	8	9
quite a bit					a little			not at all

IF YOU EVER TOOK PART IN AN EXPERIMENT SUCH AS THIS AGAIN

1. How much help would you like from the teacher when you go to work?

1	2	3	4	5	6	7	8	9
no help		very little		a little		a fair amount		much help

2. Would you do better working with another student?

1	2	3	4	5	6	7	8	9
not at all		maybe		a little		a fair amount		quite a bit

3. How often would it be wise to show your work to the teacher to be sure that you are on the right track?

1	2	3	4	5	6	7	8	9
not at all		maybe once		just once		several times		as frequently as needed

4. How sure are you about your answers to questions 1, 2, and 3 above?

1	2	3	4	5	6	7	8	9
very sure				fairly sure				very unsure

5. How interested do you think you would be in working on these problems again?

1	2	3	4	5	6	7	8	9
very interested				fairly interested				very interested

6. How sure are you about your answer to question 5 above?

1	2	3	4	5	6	7	8	9
very sure				fairly sure				very unsure

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IT'S A MATTER OF OPINION

The University of Minnesota is doing some research to find out about attitudes that junior high school boys and girls have about their teachers and their classrooms. To do this we are going to ask the people who ought to know the most about these attitudes--you boys and girls who are in junior high school. The "teacher" that these questions talk about is the teacher in the class you are NOW in.

There are no right or wrong answers to the questions below. We are interested in YOUR OWN OPINIONS, so mark the answer that fits you best. We want only your own reactions to the questions below, so avoid looking at another's answer sheet.

No one in your school will see your answers. In fact, the answer sheets will be scored by machine, so even the University people will not see your answer sheet.

INSTRUCTIONS

There are three parts to this questionnaire. Here are the instructions for Part I: You have on your desk a set of questions, a special answer sheet, and a special pencil. When you have decided on your own feeling about each question, use the special pencil to mark your answer on the answer sheet. Answer Question 1 in the space marked 1 on your answer sheet. Answer Question 2 in the space marked 2 on your answer sheet. Do the same thing for all the other questions. Do NOT write on the questionnaire.

If you think the answer to the question is YES, make a black mark in the column of your answer sheet marked Y (for "yes"). If you think the answer to the question is NO, make a black mark in the column of your answer sheet marked N (for "no"). GIVE ONLY ONE ANSWER FOR EACH QUESTION.

EXAMPLE: 0. Are boys noisier than girls?

It is obvious that sometimes boys are noisier than girls, and at other times girls are noisier than boys. It all depends on the situation. If you think that boys are noisier more often than girls, you would make a mark in the column marked Y on your answer sheet, like this:

	Y	N
0.	■	▯

If you think that girls are noisier more often than boys, you would make a mark in the column marked N on your answer sheet, like this:

	Y	N
0.	▯	■

Before you begin, be sure you put in your name and the other information asked for on the ANSWER SHEET. You may now begin. Work as fast as you can, but DO NOT SKIP ANY OF THE QUESTIONS. When you finish, you may go on to Part II.

IT'S A MATTER OF OPINION
PART I

1. Does your teacher have lots of fun with you?
2. Do you pretend to be busy when you are not?
3. Are you ever afraid that you won't pass?
4. Is Minnesota the largest state in the United States?
5. Does your teacher scold you in front of the class?
6. Would you work just as hard if there were no tests?
7. Are you glad when a substitute teacher takes your teacher's place?
8. Do you find it easy to talk to your teacher?
9. Does the teacher make you feel foolish?
10. When you get home every day do you like to talk about what you did at school?
11. Are there some things you do nearly every day that you hope the teacher won't find out?
12. Do both Minneapolis and St. Paul have a daily newspaper?
13. Do you get along well with your teacher?
14. Does your teacher ever make you feel ashamed?
15. Has your teacher ever punished you for something you didn't do?
16. Do you have more time to finish your class assignment if you need it?
17. Do you dislike your teacher?
18. Is your teacher one of the very best ones you've ever had?
19. Do you hide things from your teacher?
20. Is the Capitol of the United States located in the state of Washington?
21. Is it easy to make your teacher angry?
22. Are you ever punished because you didn't get your work done?
23. Do you bring something from home to show the class more than once a week?
24. Are there times in your class when you almost want to cry?
25. Are you so interested in your work that you always try your best?
26. Does the teacher ever use a ruler or pencil to hit you?
27. Is your teacher always kind?

28. Have you ever been "pushed" or "shaken" by your teacher in anger?

29. Is Lake Superior one of the "Great Lakes?"

30. Is your teacher ever too busy to talk to you?

31. Is your teacher always fair with bad boys and girls?

32. Does the teacher expect you to finish all the work that is assigned by the end of the period?

33. Is your teacher too bossy?

34. Would you like to have the same teacher next year?

When you have finished Part I, you may go on to Part II. Check to make sure you have put your name and the other information asked for on the ANSWER SHEET.

INSTRUCTIONS

Part II is just like Part I except that the items are statements, not questions. Again, there are NO right or wrong answers to these statements. We are interested in YOUR OWN OPINIONS, so mark the answer that fits you best.

If you AGREE (or tend to agree) with a statement, put a black mark in the column marked Y (for "yes"). If you DISAGREE (or tend to disagree) with a statement, put a black mark in the column marked N (for "no"). GIVE ONLY ONE ANSWER FOR EACH STATEMENT.

Notice that these statements start at number 61. Therefore,answer Statement 61 in the space marked 61 on your answer sheet. (This is at the top of the third column.) Answer Statement 62 in the space marked 62 on your answer sheet. Do the same thing for all other statements. Use your SPECIAL PENCIL to mark your answers on the answer sheet.

Now you may begin. Work as fast as you can, but BE SURE TO ANSWER EVERY ITEM.

IT'S A MATTER OF OPINION
PART II (Dependence Scale)

61. I hesitate to ask for help from others.

62. Some boys and girls are natural leaders.

63. I like to do things with my family.

64. It's fun to try out ideas that others think are crazy.

65. I enjoy working with students who get good marks.

66. Students ought to be allowed to help one another with their school work.

67. I don't need my friends' encouragement when I meet with failure.

68. I never argue with my parents.

69. My folks usually have to ask me twice to do something.

70. I don't like my friends to make a fuss over me when I am sick.

71. I seldom do "little extra things" at home, just to please my parents.

72. I want my friends to leave me alone when I am sad.

73. I often disagree with my parents.

74. I never do anything at home until I find out if it's OK.

75. What others think of me does not bother me.

76. Committee work is a waste of time.

77. I often disagree with what the class decides to do.

78. You should always check to see if your parents approve of your friends.

79. A good friend will never disagree with you.

80. I enjoy studying about things that my parents don't like.

81. I am apt to pass up something I want to do when others think it isn't worth doing.

82. I think I'm going to leave home earlier than other boys and girls.

83. I owe my greatest obligation to my family.

84. I don't like to show my friends how much I like them.

85. I like to make my own decisions.

86. My parents make unreasonable rules.

87. Rules are made to be broken.

88. I would rather be left alone when I am in trouble.

89. I would never tell on a student who has done something wrong.

90. It annoys me when my friends tell me their troubles.

91. I dislike lending things to my friends.

92. I like people who ignore the feelings of others.

93. I don't care whether or not I take home a good report card.

94. I often seem to do thi[illegible] my parents don't like.

95. My parents treat me more like a child than a teen-ager.

96. I don't care if other students say nice things about me.

97. I sometimes break rules if it makes my friends like me.

98. I like to criticize people who are in charge.

99. I try never to disobey my parents.

100. I don't try to get my own way when I have differences with my parents.

101. I feel better when I give in and avoid a fight than I would if I tried to have my own way.

102. I don't really like to follow instructions and to do what is expected of me.

103. My family does not like what I intend to choose for my life work.

104. I often disagree with what the teacher says.

105. In class it is best to go along with the majority even when you disagree.

106. I seldom argue with other students who are leaders.

107. The umpire is always right.

108. I don't care if others are interested in the same things that I am.

109. It is not always best to have the majority make the decision.

110. The playground is a poor place to really get to know your friends.

When you have answered all the statements in Part II, you may go on to Part III.

COMBINED MATRIX FOR INDIRECT SOCIAL STUDIES TEACHERS, N = 7

(R 701, P 703, C 704, L 706, H 704, P 701, M 701)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	8	9	3	3	2	4	2	31
2	3	32	74	83	69	13	4	12	35	27	352
3	1	39	714	501	525	49	12	101	212	180	2334
4	5	9	22	618	166	48	19	1631	338	176	3032
5	11	29	38	792	8758	203	73	45	319	289	10557
6	2	3	3	92	158	451	43	113	62	284	1211
7	2	2	3	47	85	33	191	12	17	84	476
8	--	137	723	502	303	90	28	2932	122	108	4945
9	2	92	733	180	213	55	30	8	1250	109	2672
10	5	9	24	209	271	266	73	89	313	1325	2584
TOTAL	31	352	2334	3032	10557	1211	476	4945	2672	2584	28,194

COMBINED MATRIX FOR DIRECT SOCIAL STUDIES TEACHERS, N = 8
(R 702, F 701, D 706, Q 701, A 701, D 708, G 703, B 704)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	4	1	1	--	--	3	--	9
2	--	13	22	67	75	33	7	13	17	27	274
3	1	16	98	160	210	26	17	44	79	67	718
4	2	6	13	491	78	79	42	1472	186	184	2553
5	1	26	19	699	4028	371	115	119	313	378	6069
6	3	7	4	138	208	890	97	272	175	539	2333
7	--	9	2	141	120	104	569	46	77	189	1257
8	--	134	305	460	605	190	112	3009	119	141	5075
9	--	42	242	121	394	196	81	10	834	137	2057
10	2	21	13	272	350	443	217	90	254	1634	3296
TOTAL	9	274	718	2553	6069	2333	1257	5075	2057	3296	23641

COMBINED MATRIX FOR INDIRECT MATHEMATICS TEACHERS, N = 7
(D 804, C 801, I 801, P 805, A 803, M 805, V 803)

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	3	1	3	9	30	1	1	1	3	8	59
2	1	42	71	72	140	13	4	3	33	61	440
3	5	68	765	412	537	22	9	66	130	101	2115
4	7	13	19	722	176	44	8	1934	121	221	3265
5	22	33	56	1226	10014	231	44	23	312	225	12186
6	1	--	5	47	139	253	7	158	49	223	882
7	--	2	3	31	41	15	65	12	16	61	246
8	8	191	757	466	600	92	28	530	78	49	2799
9	7	76	421	93	220	46	23	4	651	56	1597
10	5	14	15	187	289	165	57	68	205	1489	2494
TOTAL	59	440	2115	3265	12186	882	246	2799	1597	2494	26083

COMBINED MATRIX FOR DIRECT MATHEMATICS TEACHERS, N = 9
(M 802, G 801, V 804, H 802, L 803, T 802, E 802, G 802, A 802)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	4	1	1	3	12	3	2	1	5	5	37
2	2	29	26	54	87	37	4	8	30	71	348
3	2	15	174	154	268	40	12	32	91	72	860
4	2	10	4	222	111	85	27	2214	188	254	3117
5	14	43	23	1127	10240	591	234	92	519	478	13361
6	1	5	1	149	313	906	111	582	202	558	2828
7	1	6	3	111	246	130	616	40	105	266	1524
8	1	138	350	818	991	379	139	1177	114	152	4259
9	6	60	266	186	670	232	129	12	487	158	2206
10	4	41	12	293	423	425	250	101	465	2172	4186
TOTAL	37	348	860	3117	13361	2828	1524	4259	2206	4186	32726

TOTAL MATRIX FOR A 701
(Classified as Direct and Average)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	--	--	--	--	1	--	1
2	--	--	1	12	5	4	--	2	--	4	28
3	--	2	14	17	26	2	5	9	7	4	86
4	--	2	3	160	20	14	12	171	4	52	438
5	1	--	3	79	572	42	10	8	18	25	758
6	--	--	1	25	18	186	6	11	12	75	334
7	--	1	--	13	12	18	94	4	2	17	161
8	--	19	38	62	44	16	11	176	14	6	386
9	--	3	25	11	18	8	3	1	100	--	169
10	--	1	1	59	43	44	20	4	11	680	863
TOTAL	1	28	86	438	758	334	161	386	169	863	3224

TOTAL MATRIX FOR B 704
(Classified as Direct and Most Direct)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	--	--	--	--	--	--	0
2	--	5	1	1	6	6	4	2	2	1	28
3	--	--	2	2	3	1	1	--	3	2	12
4	--	--	--	5	5	3	3	24	12	13	65
5	--	4	--	25	436	29	9	19	24	25	571
6	--	2	--	5	16	107	18	24	15	33	220
7	--	1	--	2	12	15	199	5	24	44	302
8	--	3	1	8	36	7	11	282	3	17	368
9	--	11	8	1	35	17	19	1	20	13	125
10	--	2	--	18	22	35	38	11	22	147	295
TOTAL	-0	28	12	65	571	220	302	370	125	295	1986

TOTAL MATRIX FOR C 704
(Classified as Indirect and Most Indirect)

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	--	--	2	--	--	--	2
2	--	--	12	2	4	--	1	--	6	5	30
3	--	4	159	62	114	15	1	33	50	76	514
4	--	--	3	72	33	6	--	168	96	10	388
5	2	4	10	148	1580	31	13	1	47	58	1894
6	--	--	--	13	38	55	4	13	8	30	161
7	--	--	--	5	11	3	55	--	1	16	91
8	--	5	74	45	53	15	2	55	12	14	275
9	--	16	252	24	27	7	5	1	272	21	625
10	--	1	4	17	34	29	8	4	133	198	428
TOTAL	2	30	514	388	1894	161	91	275	625	428	4408

TOTAL MATRIX FOR D 706
(Direct and Most Direct Classification)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	--	--	--	--	--	--	0
2	--	3	3	11	8	3	1	1	3	2	35
3	--	2	11	43	29	2	4	2	6	4	103
4	--	2	3	55	10	7	17	164	45	23	326
5	--	4	4	61	204	10	24	4	19	20	350
6	--	1	--	16	8	24	12	17	8	21	107
7	--	4	--	50	14	13	80	15	12	35	223
8	--	10	63	46	27	23	21	182	5	16	393
9	--	3	19	11	31	10	18	2	63	14	171
10	--	6	--	33	19	15	46	6	10	74	209
TOTAL	0	35	103	326	350	107	223	393	171	209	1917

TOTAL MATRIX FOR D 708

(Classified as Direct and Average)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	--	--	--	--	--	--	0
2	--	--	1	1	2	3	--	--	--	--	7
3	--	1	3	16	15	--	--	1	2	1	39
4	--	--	--	7	3	12	--	225	50	6	303
5	--	1	1	115	241	61	6	22	18	37	502
6	--	1	1	20	46	107	9	48	21	94	347
7	--	--	--	9	4	6	6	1	1	4	31
8	--	3	25	97	115	32	4	923	15	8	1222
9	--	--	8	20	63	35	2	--	121	16	265
10	--	1	--	18	13	91	4	2	37	103	269
TOTAL	0	7	39	303	502	347	31	1222	265	269	2985

TOTAL MATRIX FOR F 701
(Classified as Direct and Average)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	3	--	--	--	--	2	--	5
2	--	2	4	21	21	2	2	4	1	6	64
3	1	6	34	19	38	6	1	12	11	10	128
4	2	2	2	178	22	12	4	372	19	54	667
5	--	4	2	195	912	48	10	25	26	41	1263
6	1	1	--	13	17	63	7	28	11	81	222
7	--	1	--	33	12	5	35	2	4	15	107
8	--	42	50	121	166	24	31	681	13	29	1157
9	--	4	34	14	27	9	1	1	111	9	210
10	1	2	1	70	58	53	16	32	12	305	550
TOTAL	5	64	128	667	1263	222	107	1157	210	550	4373

TOTAL MATRIX FOR G 703

(Classified as Direct and Most Direct)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	1	--	1	--	--	--	--	2
2	--	1	3	2	10	1	--	--	4	5	26
3	--	1	--	3	42	3	1	2	4	3	59
4	--	--	3	3	1	5	--	129	14	9	164
5	--	8	1	84	855	69	29	1	117	145	1309
6	1	2	--	12	51	228	24	15	54	117	504
7	--	--	--	10	41	23	88	1	12	44	219
8	--	4	19	11	60	14	4	11	10	30	163
9	--	5	30	16	129	64	15	1	47	37	344
10	1	5	3	22	120	96	58	3	82	542	932
TOTAL	2	26	59	164	1309	504	219	163	344	932	3722

TOTAL MATRIX FOR H 704
(Classified as Indirect and Most Indirect)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	1	--	--	1	--	1	3
2	--	8	5	8	12	--	--	3	3	5	44
3	--	6	88	37	60	1	2	10	28	25	257
4	1	1	--	81	17	3	3	175	10	22	313
5	2	2	6	106	2429	17	16	2	80	35	2695
6	--	--	--	6	20	58	9	8	9	35	145
7	--	--	--	8	20	10	61	5	4	17	125
8	--	18	72	35	44	6	7	774	24	13	993
9	--	8	83	15	54	2	7	4	271	25	469
10	--	1	3	17	38	48	20	11	40	207	385
TOTAL	3	44	257	313	2695	145	125	993	469	385	5429

TOTAL MATRIX FOR L 706
(Classified as Indirect and Most Indirect)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	3	1	2	1	--	3	--	10
2	--	6	15	9	4	7	--	5	10	1	57
3	1	5	148	78	53	9	1	17	44	8	364
4	2	1	3	162	43	4	--	277	26	36	554
5	1	1	10	120	1016	43	4	7	39	39	1280
6	2	--	1	9	22	65	5	44	7	70	225
7	1	--	1	3	8	1	6	2	1	1	24
8	--	30	90	118	58	23	5	1149	30	17	1520
9	1	14	93	26	20	10	1	3	286	5	459
10	2	--	3	26	55	61	1	16	13	307	484
TOTAL	10	57	364	554	1280	225	24	1520	459	484	4977

TOTAL MATRIX FOR M 701
(Classified as Indirect and Most Indirect)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	2	--	--	--	--	--	--	2
2	1	1	10	31	13	1	--	1	3	1	62
3	--	3	13	67	39	8	--	--	7	5	142
4	--	1	3	66	14	9	4	248	99	13	457
5	--	3	2	109	253	39	12	2	13	14	447
6	--	1	--	33	23	124	3	13	15	43	255
7	--	1	--	12	10	5	10	1	1	7	47
8	--	30	71	79	38	13	4	34	37	7	303
9	--	21	42	38	43	19	4	--	156	15	338
10	1	1	1	20	14	37	10	4	17	119	224
TOTAL	2	62	142	457	447	255	47	303	338	224	2277

TOTAL MATRIX FOR P 701

(Classified as Indirect and Average)

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	1	1	1	--	--	1	--	4
2	1	6	6	9	6	1	2	1	5	6	43
3	--	5	28	85	48	6	3	4	21	23	223
4	1	1	6	57	21	14	6	272	44	30	452
5	1	4	2	82	382	17	13	5	32	47	585
6	--	--	1	19	10	36	16	27	15	36	160
7	1	--	1	10	17	10	27	2	9	26	103
8	--	12	104	93	43	28	10	435	15	19	759
9	--	12	73	53	27	11	11	--	87	24	298
10	--	3	2	43	30	36	15	13	69	113	324
TOTAL	4	43	223	452	585	160	103	759	298	324	2951

TOTAL MATRIX FOR P 703
(Classified as Indirect and Most Indirect)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	2	2	--	--	--	--	1	5
2	1	6	19	21	12	4	--	2	5	6	76
3	--	14	147	122	109	3	1	22	5	28	451
4	1	5	7	223	28	8	3	338	12	56	681
5	--	6	2	134	1122	34	1	27	35	57	1419
6	--	1	--	8	28	84	4	6	3	48	182
7	--	--	--	3	1	3	17	2	--	11	37
8	--	34	228	88	45	3	--	458	9	27	893
9	1	0	43	11	29	2	1	--	97	9	202
10	1	1	5	69	42	41	10	38	36	278	521
TOTAL	5	76	451	681	1419	182	37	893	202	521	4467

TOTAL MATRIX FOR Q 701
(Classified as Direct and Most Direct)

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	--	--	--	--	--	--	0
2	--	2	5	18	22	14	--	2	4	9	76
3	--	3	2	16	12	1	2	1	1	4	42
4	--	--	1	21	7	9	4	220	7	7	276
5	--	5	3	82	385	59	16	19	21	26	616
6	--	--	--	24	28	73	9	63	30	50	277
7	--	2	--	21	12	14	37	15	10	14	125
8	--	49	21	58	91	38	27	168	30	11	493
9	--	11	9	16	38	33	11	2	85	14	219
10	--	4	1	20	21	36	19	3	31	79	214
TOTAL	0	76	42	276	616	277	125	493	219	214	2338

TOTAL MATRIX FOR R 701

(Classified as Indirect and Most Indirect)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	4	--	--	1	--	--	5
2	--	5	7	3	18	--	1	--	3	3	40
3	--	2	131	50	102	7	4	15	57	14	382
4	--	--	--	30	10	4	3	153	51	9	260
5	4	9	6	93	1976	22	14	1	73	39	2237
6	--	1	1	4	17	29	2	2	5	22	83
7	--	1	1	6	18	1	15	--	1	6	49
8	--	8	84	44	21	2	--	27	5	11	202
9	--	12	147	13	13	4	1	--	81	10	281
10	1	2	5	17	58	14	9	3	5	103	217
TOTAL	5	40	382	260	2237	83	49	202	281	217	3756

TOTAL MATRIX FOR R 702

(Classified as Direct and Average)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	1	--	--	--	--	--	1
2	--	--	3	1	1	--	--	2	3	--	10
3	--	1	32	46	55	11	3	17	45	39	249
4	--	--	1	62	10	17	2	167	35	20	314
5	--	--	5	58	423	53	11	21	70	59	700
6	1	--	2	23	24	102	12	66	24	68	322
7	--	--	2	3	13	10	30	3	12	16	89
8	--	4	88	57	66	36	3	586	29	24	893
9	--	5	109	32	53	20	12	2	287	34	554
10	--	--	7	32	54	73	16	29	49	384	644
TOTAL	1	10	249	314	700	322	89	893	554	644	3776

TOTAL MATRIX FOR A 802
(Classified as Direct and Most Direct)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	1	1	2	--	--	--	4
2	--	6	--	1	15	--	1	--	--	10	33
3	--	2	8	--	5	--	--	1	2	--	18
4	--	--	--	59	14	3	4	215	1	29	325
5	4	10	2	156	3039	86	106	24	26	88	3541
6	--	--	--	2	54	40	8	36	--	55	195
7	--	1	--	18	109	13	164	9	3	34	351
8	--	4	4	66	171	12	34	181	--	16	488
9	--	3	3	--	34	1	7	--	21	3	72
10	--	7	1	23	99	39	25	22	19	320	555
TOTAL	4	33	18	325	3541	195	351	488	72	555	5582

TOTAL MATRIX FOR A 803
(Classified as Indirect and Most Indirect)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	1	--	--	--	--	1	2
2	--	28	7	12	17	4	--	--	8	35	111
3	1	6	75	86	75	4	3	9	35	30	324
4	--	1	3	25	11	3	3	318	24	17	405
5	--	6	5	133	512	24	2	2	78	33	795
6	1	--	2	15	15	29	--	44	14	27	147
7	--	1	1	2	4	4	9	1	--	16	38
8	--	25	124	81	70	40	1	30	26	11	408
9	--	34	104	27	45	12	3	2	70	6	303
10	--	10	3	24	45	27	17	2	48	243	419
TOTAL	2	111	324	405	795	147	38	408	303	419	2952

TOTAL MATRIX FOR C 801
(Classified as Indirect and Most Indirect)

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	1	3	2	7	--	--	--	1	3	17
2	1	12	7	10	38	1	2	--	9	3	83
3	2	14	127	21	52	--	--	7	26	18	267
4	--	5	1	40	11	1	--	209	12	33	312
5	4	5	4	191	2649	11	14	3	49	36	2966
6	--	--	--	--	1	13	--	1	1	27	43
7	--	--	--	1	10	--	21	4	2	14	52
8	3	35	39	28	119	--	2	40	2	8	276
9	4	9	82	--	23	1	2	--	112	12	245
10	3	2	4	19	56	16	11	12	31	254	408
TOTAL	17	83	267	312	2966	43	52	276	245	408	4669

TOTAL MATRIX FOR D 804
(Classified as Indirect and Most Indirect)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	1	--	--	1	6	--	1	--	--	--	9
2	--	4	16	9	10	--	2	1	6	1	49
3	1	11	233	104	88	4	1	20	19	9	490
4	3	--	8	225	43	9	--	311	36	24	659
5	2	6	8	159	1423	23	3	2	47	28	1701
6	--	--	1	5	17	34	--	14	2	24	97
7	--	--	--	4	4	--	1	--	--	--	9
8	1	19	160	96	44	4	1	264	23	6	618
9	1	9	64	35	27	2	--	--	211	5	354
10	--	--	--	21	39	21	--	6	10	165	262
TOTAL	9	49	490	659	1701	97	9	618	354	262	4248

TOTAL MATRIX FOR E 802
(Classified as Direct and Average)

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	--	--	--	--	--	1	1
2	--	--	3	12	5	11	--	--	6	9	46
3	--	--	--	8	16	1	--	3	6	1	35
4	--	1	--	8	5	5	1	207	37	37	301
5	1	2	1	86	564	97	11	12	86	50	910
6	--	--	--	17	28	102	4	132	41	97	421
7	--	--	--	8	8	10	25	1	13	21	86
8	--	26	22	74	114	58	9	552	56	17	928
9	--	17	9	41	133	61	19	8	95	42	425
10	--	--	--	47	37	76	17	13	85	351	626
TOTAL	1	46	35	301	910	421	86	928	425	626	3779

TOTAL MATRIX FOR G 801
(Classified as Direct and Most Direct)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	1	--	--	--	--	--	--	3	1	5
2	--	1	6	1	6	--	--	1	--	4	19
3	--	--	74	6	49	2	--	1	18	31	181
4	--	2	--	31	8	2	--	86	8	21	158
5	1	--	5	71	1364	36	18	1	63	59	1618
6	--	--	--	2	25	75	13	63	17	53	248
7	--	--	1	2	19	17	65	2	9	66	181
8	--	10	24	15	28	58	4	24	3	13	179
9	4	4	70	13	71	22	11	--	77	19	291
10	--	1	1	17	48	36	70	1	93	305	572
TOTAL	5	19	181	158	1618	248	181	179	291	572	3452

TOTAL MATRIX FOR G 802

(Classified as Direct and Most Direct)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	--	--	--	--	--	--	0
2	--	--	--	--	--	--	1	--	--	1	2
3	--	--	10	5	9	3	5	--	14	17	63
4	--	--	2	2	2	9	2	40	14	--	71
5	--	--	--	26	239	35	15	1	37	19	372
6	--	--	--	9	39	155	38	6	49	61	357
7	--	2	1	7	12	42	82	2	42	41	251
8	--	--	1	7	18	9	6	6	7	3	57
9	--	--	46	4	35	46	38	2	54	44	269
10	--	--	3	11	18	58	44	--	52	365	551
TOTAL	0	2	63	71	372	357	231	57	269	551	1973

TOTAL MATRIX FOR H 802
(Classified as Direct and Average)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	3	--	1	1	7	2	--	--	--	1	15
2	2	4	3	6	16	11	--	3	9	16	70
3	1	6	12	19	56	15	--	11	14	3	137
4	--	5	2	26	20	30	3	363	20	25	494
5	4	11	10	171	800	127	13	23	111	56	1326
6	--	4	1	45	62	169	15	123	48	106	573
7	1	--	--	14	15	17	26	6	10	26	115
8	--	17	54	121	216	79	19	223	17	18	764
9	2	18	53	47	97	43	18	1	53	16	348
10	2	5	1	44	37	80	21	11	66	134	401
TOTAL	15	70	137	494	1326	573	115	764	348	401	4243

TOTAL MATRIX FOR I 801
(Classified as Indirect and Most Indirect)

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	1	--	--	2	6	--	--	1	1	1	12
2	--	5	14	9	23	--	--	--	--	6	57
3	--	15	89	39	55	1	--	3	2	5	209
4	2	--	4	163	31	12	--	167	9	40	428
5	6	7	15	151	1435	24	3	9	4	34	1688
6	--	--	--	4	20	32	--	17	1	22	96
7	--	--	--	--	2	--	--	--	1	--	3
8	2	26	69	33	66	3	--	40	--	7	246
9	--	4	16	3	9	--	--	--	13	2	47
10	1	--	2	24	41	24	--	9	16	125	242
TOTAL	12	57	209	428	1688	96	3	246	47	242	3028

TOTAL MATRIX FOR L 803
(Classified as Direct and Most Direct)

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	--	--	--	--	1	1	2
2	--	--	6	5	12	5	--	--	1	1	30
3	--	3	5	10	19	4	1	--	7	4	53
4	1	--	--	6	7	3	1	155	7	11	191
5	--	5	--	93	513	49	10	3	41	26	740
6	1	--	--	15	20	43	4	25	14	28	150
7	--	--	--	4	10	3	3	--	1	1	22
8	--	21	21	32	81	12	--	8	10	7	192
9	--	1	20	10	58	15	1	--	20	5	130
10	--	--	1	16	20	16	2	1	28	141	225
TOTAL	2	30	53	191	740	150	22	192	130	225	1735

TOTAL MATRIX FOR M 802
(Classified as Direct and Average)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	1	--	--	--	--	--	1
2	--	--	2	17	12	4	1	1	6	4	47
3	--	--	8	66	46	9	1	3	--	3	136
4	--	--	--	35	15	11	3	697	10	31	801
5	1	6	1	214	383	77	5	14	27	35	763
6	--	--	--	40	37	67	7	82	24	64	321
7	--	1	--	9	5	6	5	4	5	7	42
8	--	30	124	342	184	72	10	31	9	44	846
9	--	7	--	36	64	27	3	--	20	11	168
10	--	3	1	42	16	48	8	14	67	97	296
TOTAL	1	47	136	801	763	321	42	846	168	296	3421

TOTAL MATRIX FOR M 805
(Classified as Indirect and Average)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	1	7	--	--	--	--	1	9
2	--	--	15	9	19	1	--	1	2	--	47
3	1	9	45	82	107	5	1	7	8	4	269
4	--	3	--	101	29	12	4	373	24	49	595
5	7	5	12	229	712	51	9	3	38	40	1106
6	--	--	1	12	29	42	4	26	11	47	172
7	--	1	1	8	11	9	15	3	1	10	59
8	1	27	179	83	97	11	11	34	4	6	453
9	--	1	14	17	58	15	1	--	28	9	143
10	--	1	2	53	37	26	14	6	27	153	319
TOTAL	9	47	269	595	1106	172	59	453	143	319	3172

TOTAL MATRIX FOR P 805
(Classified as Indirect and Most Indirect)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	2	2	1	--	--	--	--	5
2	--	2	8	12	18	1	--	--	--	--	41
3	--	7	28	38	53	--	--	9	1	1	137
4	2	3	1	127	42	3	1	268	2	24	473
5	3	2	3	209	1543	25	1	3	6	31	1826
6	--	--	--	5	21	16	--	1	--	12	55
7	--	--	--	4	1	1	3	1	--	4	14
8	--	27	89	55	107	1	5	29	1	3	317
9	--	--	7	--	6	--	--	--	1	--	14
10	--	--	1	21	33	7	4	6	3	173	248
TOTAL	5	41	137	473	1826	55	14	317	14	248	3130

TOTAL MATRIX FOR T 802

(Classified as Direct and Most Direct)

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	--	5	--	--	--	--	--	1
2	--	--	--	2	2	--	--	1	5	2	12
3	--	1	10	14	22	--	2	2	15	3	69
4	--	--	--	16	15	10	--	196	86	39	362
5	1	--	4	155	1717	27	27	8	112	59	2110
6	--	--	--	6	19	27	8	17	7	22	106
7	--	--	--	21	25	5	121	4	17	17	210
8	--	5	17	84	92	8	12	49	9	15	291
9	--	5	35	30	161	13	20	1	108	12	385
10	--	1	3	34	56	16	20	13	26	182	351
TOTAL	1	12	69	362	2110	106	210	291	385	351	3897

TOTAL MATRIX FOR V 803
(Classified as Indirect and Most Indirect)

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	--	--	--	1	1	--	--	--	--	2	4
2	--	1	4	11	15	6	--	1	8	16	62
3	--	6	168	42	107	8	4	11	39	34	419
4	--	1	2	41	9	4	--	288	14	34	393
5	--	2	9	154	1740	73	12	1	90	23	2104
6	--	--	1	6	36	87	3	55	20	64	272
7	--	--	1	12	9	1	26	3	12	17	81
8	1	32	97	90	97	33	8	93	22	8	481
9	2	19	134	11	52	16	17	2	216	22	491
10	1	1	3	25	38	44	11	27	70	376	596
TOTAL	4	62	419	393	2104	272	81	481	491	596	4903

TOTAL MATRIX FOR V 804
(Classified as Direct and Average)

CATEGORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	1	--	--	2	2	--	--	1	1	1	8
2	--	18	6	10	19	6	1	2	3	24	89
3	1	3	47	26	46	6	3	11	15	10	168
4	1	2	--	39	25	12	14	255	5	61	414
5	2	9	--	155	1621	57	29	6	16	86	1981
6	--	1	--	13	29	228	14	98	2	72	457
7	--	2	1	28	43	17	125	12	5	53	286
8	1	25	83	77	87	71	45	103	3	19	514
9	--	5	30	5	17	4	12	--	39	6	118
10	2	24	1	59	92	56	43	26	29	278	610
TOTAL	8	89	168	414	1981	457	286	514	118	610	4645

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Table One

MEANS AND VARIANCES OF PRE AND FINAL ACHIEVEMENT MEASURE
SOCIAL STUDIES

Teacher Style	Class Code	N	Pre-test		Final test	
			Mean	Variance	Mean	Variance
Indirect	R 701	30	24.30	37.46	35.53	36.22
	P 703	28	23.07	29.70	32.78	34.40
	C 704	23	27.57	28.98	37.43	35.43
	L 706	32	28.59	26.38	40.47	22.57
	H 704	26	26.35	37.12	35.88	35.79
	P 701	30	23.23	19.91	33.43	40.87
	M 701	30	28.10	32.23	39.67	50.71
	All Ss	199	25.87	34.06	36.51	36.57
Direct	R 702	27	25.04	58.96	35.41	39.25
	F 701	29	29.48	29.54	37.97	51.89
	D 706	27	25.70	26.83	30.59	21.94
	Q 701	24	26.29	29.09	34.92	43.30
	A 701	25	25.04	39.87	34.20	33.75
	D 708	29	25.55	17.40	35.66	27.59
	G 703	22	22.64	23.86	32.00	46.19
	B 704	28	22.00	14.07	24.43	28.92
	All Ss	211	25.29	33.59	33.15	36.60

C.R. = 5.62

Table Two

MEANS AND VARIANCES OF PRE AND FINAL ACHIEVEMENT MEASURE
MATHEMATICS

Teacher Style	Class Code	N	Pre-test		Final test	
			Mean	Variance	Mean	Variance
Indirect	D 804	29	23.83	80.22	33.0	143.3
	C 801	24	23.58	59.64	30.8	48.6
	I 801	24	22.67	61.71	29.2	83.3
	P 805	32	15.72	46.53	25.6	122.6
	A 803	27	12.41	32.48	18.4	55.2
	M 805	29	21.00	73.07	27.8	114.7
	V 803	28	26.50	129.96	34.8	98.5
	All Ss	193	20.67	87.61	28.5	120.0
Direct	M 802	25	23.88	63.03	32.1	97.7
	G 801	19	19.00	121.33	19.8	208.4
	V 804	24	23.80	100.50	34.4	121.9
	H 802	27	22.48	136.72	28.2	172.8
	L 803	15	12.00	32.28	15.4	73.3
	T 802	21	20.57	49.36	26.5	70.6
	E 802	20	27.25	58.09	31.2	69.5
	A 802	22	21.27	64.11	28.6	72.1
	G 802	19	12.53	23.82	16.4	40.8
	All Ss	193	20.84	93.13	26.7	141.1

C.R. = 1.55

MINNESOTA STUDENT ATTITUDE INVENTORY

This is not a test because there are no wrong answers. The answer to each question is A MATTER OF OPINION and your true opinion, whatever it is, IS THE RIGHT ANSWER. You will be asked a lot of questions about how much you like this class, the teacher, and the work you are doing here. All the questions refer to THIS ONE CLASS AND THIS PARTICULAR TEACHER. By giving frank, true answers to show exactly how you feel, you can help us understand the opinions of students.

DIRECTIONS:
1. Please make sure your name is on the answer sheet.
2. Do not skip any questions--answer each one carefully.
3. Make sure that the number on the answer sheet matches the question number when you mark your answer. Double check when you are asked.

EXAMPLE: 0. IN THIS CLASS WE RECITE OUT LOUD.

Here are the four alternatives you can choose from. A--every day; B--most days; C--a few days; D--no days. One of these will be most true for you. Here is how you will decide which one is most true for you.

1. If you think you recite out loud every day in this class, you should choose "A"--every day, and put an X on "A" on your answer sheet.

OR 2. If you don't think you recite out loud in this class at all, you should choose "D"--no days, and put an X on "D" on your answer sheet.

OR 3. If you are not quite sure, but think you recite out loud quite often, you should choose "B"--most days, and put an X on "B" on your answer sheet.

OR 4. If you think you recite out loud only once in a while, you should choose "C"--a few days, and put an X on "C" on your answer sheet.

Sometimes you must choose your answer from A--every day, B--most days, C--a few days, or D--no days, as we have just shown you. Question number 1 on your paper is this same kind. On other questions you must choose from A--strongly agree, B--agree, C--disagree, and D--strongly disagree. You will see clearly when we want you to do this, because your choices are written under each question. Here is an example of this other type of question:

EXAMPLE: 00. I THINK MY HOMEWORK IS VERY HARD.

Here are the four alternatives you can choose from. A--strongly agree; B--agree; C--disagree; or D--strongly disagree. One of these will be most true for you. Here is how you will decide which one is most true for you.

1. If you think that your homework is very hard most of the time, you should choose answer "A"--strongly agree, and put an X on "A" on your answer sheet.

OR 2. If you don't think that your homework is very hard, you should choose answer "D"--strongly disagree and put an X on "D" on your answer sheet.

OR 3. If you are not quite sure, but you tend to find your homework hard more than half the time, choose answer "B"--agree, and put an X on "B" on your answer sheet.

OR 4. If your homework tends to be hard less than half the time, choose answer "C"--disagree, and put an X on "C" on your answer sheet.

DO NOT WRITE ON THIS QUESTIONNAIRE BECAUSE OTHER STUDENTS WILL HAVE TO USE IT.

MINNESOTA STUDENT ATTITUDE INVENTORY

1. When this teacher asks us to be quiet, we know there is a good reason.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

2. This teacher makes you feel good when you do your work well.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

3. This teacher never tries to make you feel ashamed.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

4. This teacher becomes confused easily.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

5. We behave well in this class even when the teacher is out of the room.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

6. Most of us get pretty bored in this class.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

7. This teacher wants to check our work to make sure we are on the right track.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

8. I'm afraid of the grade(s) this teacher will give me.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

9. Sometimes things "get out of control" in this class.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

10. This teacher says something nice when my work is well done.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

11. This teacher never asks trick questions to show how dumb we are.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

12. It is fun to see how much we can whisper before we get caught.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

13. In this class I pretend to be busy even when I'm not.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

14. Our teacher never gives us extra assignments as punishment.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

15. If you want to work alone, this teacher will let you.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

16. The Capitol of the United States is located in Seattle, Washington.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

17. This teacher is too bossy.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

18. This teacher punishes me for things I don't do.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

19. This teacher threatens us, but we know he(she) doesn't mean it.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

20. This teacher asks our opinion in planning work to be done.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

21. I just don't trust this teacher.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

22. This teacher likes us to help each other with our work.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

23. This teacher is too strict.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

24. Sometimes just thinking about this class makes me sick.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

25. This teacher never "picks on" certain boys and girls.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

26. Our school work is done exactly as the teacher says and no other way will do.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

27. Sometimes I think this teacher is deaf.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

28. I have bad dreams about this class.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

29. I find it easy to talk to this teacher.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

30. I think this teacher has a grudge against me.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

31. I'm afraid to raise my hand in this class.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

32. Minnesota is the largest state in the Union.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

33. This teacher likes us to go ahead on our own.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

34. There is something about this class that makes me feel very uneasy.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

35. If I could get away with it, I'd sure like to tell this teacher off!
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

36. This teacher allows sutdents to take charge of the class even when he(she) is in the room.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

37. It seems like I never do anything right in this class.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

38. It seems that somebody is always getting punished in this class.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

39. Most of the work we do in this class we plan ourselves.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

40. This class is noisy and fools around a lot.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

41. This teacher sends boys and girls out of the room as punishment.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

42. I get along well with this teacher.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

43. This teacher can't tell whether we've done our work well or not.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

44. I wish I could get even with this teacher.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

45. If this teacher were absent, we could still figure out what to do next.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

46. This teacher is very unfriendly.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

47. In this class we fool around a lot in spite of the teacher.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

48. Lake Superior is one of the "Great Lakes."
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

49. This teacher has lots of fun with us.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

50. This teacher will punish the whole class when he(she) can't find out who did something bad.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

51. You can't walk around in this class without permission.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

52. If there were no tests, I would work just as hard in this class.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

53. This teacher has some special favorites or "teacher's pets."
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

54. There are times in this class when I almost want to cry.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

55. I really like this teacher.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

56. There are things I do nearly every day that I hope this teacher won't find out.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

57. This teacher makes sure WE understand our work.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

58. I get nervous and upset about this class.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

59. I can't do my best work in this class.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

60. This teacher has lost the respect of the class.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

61. This teacher is too busy to talk with me.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

62. When we raise a fuss, this teacher gives in.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

63. This teacher keeps order with a fair and firm hand.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

64. In the United States a quarter (25 cents) is larger than a dime (10 cents).
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

65. This teacher dislikes boys and girls my age.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

66. We often complain just to get out of work.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

67. Frankly, we just don't obey the teacher in this class.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

68. This teacher couldn't be mean to anyone.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

69. In this class you will be punished if you don't finish your work.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

70. This teacher pretends not to watch us when he (she) actually is.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

71. This teacher really understands boys and girls my age.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

72. It is easy to fool this teacher.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

73. Frankly, we don't pay attention to this teacher.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

74. I think of this teacher as one of my good friends.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

75. This teacher never scolds you in front of the class.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

76. This teacher is one of the best I have ever had.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

77. This teacher never gets angry and shouts at us.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

78. This teacher is cool and calm.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

79. This teacher never slaps us or handles us roughly.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

80. Usually boys and girls go to elementary school before going to high school.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

81. We work harder for this teacher than any other.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

82. This teacher never pushes us or shakes us in anger.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

83. This teacher makes very careful plans for each day's work.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

84. This teacher helps us get the most out of each hour.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

85. I really enjoy this class.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

86. Our teacher is very good at explaining things clearly.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

87. This teacher makes everything seem interesting and important.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

88. I work hard in this class because it is so interesting.
A--EVERY DAY B--MOST DAYS C--A FEW DAYS D--NO DAYS

89. I wish I could have this teacher next year.
A--STRONGLY AGREE B--AGREE C--DISAGREE D--STRONGLY DISAGREE

Table Three

I/D RATIOS OF SOCIAL STUDIES TEACHERS FOR DIFFERENT CLASSROOM ACTIVITIES

Teacher Style	Class Code	Rout.	Eval.	Work	Plan.	New Mat.	Disc.
Indirect	R 701	.40	2.86	1.00	2.43	3.90	3.61
	P 703	.59	1.14	.68	12.33	3.25	9.15
	C 704	.07	.93	2.49	4.06	4.00	.42
	L 706	--	.91	.05	14.00	5.40	1.97
	H 704	.21	1.58	.51	15.33	.93	.58
	P 701	3.27	.61	1.51	5.14	.38	1.72
	M 701	.13	.40	--	1.04	1.85	1.08
Direct	R 702	.06	.21	.42	2.21	.43	.75
	F 701	.17	.36	--	2.17	.78	.79
	D 706	.21	.35	--	--	--	.51
	Q 701	.13	.16	.12	1.19	.23	.51
	A 701	.44	.22	.05	1.42	.18	.44
	D 708	--	.10	.01	--	.23	.46
	G 703	--	.05	.01	.20	.31	.77
	B 704	.16	.19	.02	.30	.10	.13

Table Four

I/D RATIOS OF MATHEMATICS TEACHERS FOR DIFFERENT CLASSROOM ACTIVITIES

Teacher Style	Class Code	Rout.	Eval.	Work	New Mat.	Disc.
Indirect	D 804	1.43	9.15	8.50	3.64	6.83
	C 801	2.00	2.24	3.45	6.24	7.44
	I 801	.14	2.86	.48	5.88	3.33
	P 805	--	3.89	--	2.24	8.00
	A 803	1.04	1.71	1.90	2.79	10.00
	M 805	.14	1.24	.14	2.93	1.98
	V 803	.09	1.01	2.58	4.19	1.42
Direct	M 802	--	.04	.15	.72	1.33
	G 801	.02	1.17	.51	.73	1.32
	V 804	.30	.28	.38	.82	.48
	H 802	.07	.40	.28	.46	.13
	L 803	.78	.37	.13	1.00	.21
	T 802	.15	.15	.09	.38	.34
	E 802	--	.15	.14	.23	.16
	G 802	.13	.25	.11	.74	.01
	A 802	--	.15	.36	.10	.04

APPENDIX E

This entire appendix consists of a pre-publication draft of an article reporting our work on the dependence proneness test.

This work was carried out during the first year.

MEASURING DEPENDENCE PRONENESS IN THE CLASSROOM

THE PROBLEM

Some students respond to teacher directions with meticulous compliance; they are forever checking their work with the teacher to see if each step is correct; they have a strong need for support, reassurance, and supervision. Other students react with the opposite symptoms. Once they start work they prefer to be left alone; they initiate very few contacts with the teacher; their need for adult approval is more easily submerged in their task orientation. These two descriptions are at the opposite ends of a scale we choose to call dependence proneness. Presumably scores on this scale form a normal curve with most students scoring between the two extremes.

There are at least three reasons for being interested in dependence proneness. First, we have found that dependent prone students, those who score high on the scale, are more sensitive to the behavior of the teacher than are students who score low; therefore, control of this variable is essential in any experiment that compares one method of teaching with another. Second, dependent prone students will probably learn more subject matter when their greater need for supervision and personal support is satisfied; therefore, the identification of such students may be of value to the classroom teacher. Third, dependence proneness itself may be a tendency that a teacher may wish to alter as part of the educational growth of a student; therefore, a test of dependence proneness would permit an assessment of any progress made.

A dependent act that occurs in a classroom may be;unrelated to the trait of dependence proneness of the student. In a theoretical analysis of teacher influence, Flanders (13, p. 200) has suggested that the average incidence of dependent acts in a classroom is influenced by the maturity of students, type of classroom activity, clarity of the task, and average dependence proneness. The most significant factor, however, is the influence pattern used by the teacher to control class activities. A teacher who restricts student freedom much more than the average teacher, can expect more compliance and ultimately more dependence. A teacher who expands student freedom slightly more than the average teacher, can expect more creative reactions and ultimately less dependence.

The present article is a report of our efforts to construct a scale of dependence proneness that could be used to explore relationships between teacher behavior, student behavior, and student attitudes in the classroom. Our work extends rather than conflicts with the earlier studies of Wispe (23), D.E.P. Smith (21), and Gage (14) who have classified students into types, according to their different reactions to methods of instruction. Such distinctions are not made in similar studies of H.H. Anderson et al. (2, 3, 4, 5) and Cogan (11). All of these studies have as their ultimate goal the prediction of student reactions to different patterns of teacher influence.

The Development of Dependence Proneness in Children and Young Adults

Acknowledging the total dependence of the newborn infant, Heathers (17) had identified the need for affection among infants and suggests that the child develops dependence on the person who satisfies this need. Stendler (22) states that the growth of independence requires the security of the initial parent-child dependence. Sears et al (20) found that either extremely strict or extremely permissive methods of child rearing are associated with evidence of high dependence. Gewirtz (16) found that dependence toward adults has priority over dependent relationships with peers among pre-school children. It is clear that these and other researchers have identified a pattern of behavior which they call dependent and that the tendency to act in this manner is established during infancy and the pre-school years.

Other studies have been concerned with patterns of dependent behavior in school age children and young adults. Barker and Wright (8, p. 439) state that the basic dependence relation that adults extend to younger children does not change with increasing maturity; the older as well as the younger being equally protected and managed. Bernardin and Jessor (9) found that high scores on the "deference" and low scores on the "autonomy" scales of the Edwards Personal Preference Schedule were associated with greater reliance on the help of others, but no evidence of conformity on an Asch type experiment.

A survey of the literature, not fully reported here, indicates that: (a) early in life small children learn to comply to adult influence as they seek affection; (b) they also learn to conform to peer pressures and adult influence as they seek approval; (c) each child develops a balance of dependence and independence that becomes well established during the pre-school years; and (d) expectations about adult authority figures and ways of relating to them will be colored by a person's dependent tendencies.

ITEM DEVELOPMENT AND INITIAL VALIDATION

The previous research on dependence indicated that a scale of dependence proneness should include items that describe students who are complying to adults and conforming to group pressures. Our staff wrote, borrowed, and modified 150 items to form an initial battery. These items were set either in the social context of peer relationships--that is, contacts with fellow students and student leaders, or adult-child relationships--that is, with parents, teachers, and other adult authority figures. The themes of the items were either seeking help, succor, affection and affiliation, or conformity, compliance, and seeking approval.

The 150-item battery was administered to 1, 243 students in classes selected at random from the total population of eighth grade homerooms in the combined school systems of Minneapolis and St. Paul. These tests were scored by an arbitrary key. The response to each item was restricted to "agree" or "disagree."

Four separate item analyses were performed to isolate 45 items that appear in the final scale. One item analysis made use of the different reactions of students nominated by teachers as dependent and independent. A second analysis made use of students who shifted their opinions in a persuasion experiment. A third analysis, based on the same persuasion experiment, made use of students who shifted counter to the intended influence. The fourth analysis made use of the top and bottom groups formed by the total score on all 150 items. The procedures of each analysis will be briefly described.

In 33 out of 44 classrooms receiving the initial battery, the teachers were given a form containing two paragraphs. Each paragraph was a miniature case study; one described the behavior of a dependent student and the other described the behavior of an independent student. The teachers were asked to list eight names in connection with each paragraph. Four names were listed in rank order as being most like the paragraph and four names were listed in rank order as being least like the paragraph. After this form was returned by mail, each teacher received a second form. This second form described our purposes in much greater detail and included two new paragraphs giving a theoretical description of dependence and independence. Again eight names, two groups of four in rank order were requested for each paragraph with the explanation -- "Now that you understand our purposes and what we mean by dependence and independence, please write the new names without regard to the list you filled out last week." Simple numerical weights of four, three, two and one were assigned to each name in the rank order. When the same name appeared on two or more lists, the scores were combined. Thus, the score of a single student might vary from 1 to 16. Students who received a score of five or higher were assigned to the independent criterion group -- N = 106, and to the dependent criterion group -- N = 111. The net effect of combining scores was to give more weight to those nominations coming from the more consistent teachers. Such consistency could be due to greater understanding on the part of the teacher of both the paragraphs and the students; it might also be due to the presence of a particularly "pure type" of dependent or independent student.

The next item analysis was based, in part, on the work of di Vesta (12) which indicates that personality types similar to what we have defined as dependent prone are more easily persuaded than the nondependent prone. The problem was to design a persuasion experiment that could be carried out in public schools and, if possible, with a large group so that all classes that happened to be participating in a single junior high school could participate. The solution was a tape recorded procedure that could service any size. Ten opinion items, read by a narrator, were reproduced from a tape recording to which students responded by marking their answer sheets on a nine-point scale from strongly agree to strongly disagree. Items were developed and modified in pilot runs so that the initial reactions of eighth grade students would be relatively homogeneous and predictable. For example, most eighth graders react neutrally to, "Another ice age will someday return to our earth." The firsanswer sheets were collected and the Ss learned that just before marking the same items again they would hear the opinion of a famous expert recorded from radio, TV, or by special request. Before each student marked his second answers, a short but strong argument was heard. The papers were then collected and the students learned that in order to hear both sides of each argument it was only fair to listen to equally famous experts whose opinions were different from those which they had just heard. Once more the cycle was repeated. Two separate scores were used. First, the total shift score was calculated by adding all changes of opinion consistent with the intended persuasion from first to second plus second to third answers. Second, the total countershift score was calculated in the same manner except only shifts opposite to the intended persuasion were included. Again, cutting scores were arbitrarily selected to identify criterion groups at the extremes of the distribution. The total shift groups were -- high shift N = 54, low shift N = 62. The countershift groups were -- high countershift N = 84, low countershift N = 73. A total of 423 Ss took part in the persuasion experiments.

The criterion groups for the fourth item analysis were identified by the total score on the original 150 items. Rather than use the top and bottom 27% recommended by Kelley (19), the top and bottom 100 Ss or 8.05% were selected. The reason for deviating from accepted practice is that our large total "N" permitted us the luxury of decreasing errors of assignment to the top and bottom groups. The cost of this decision was our inability to use a standrard item analysis chart based on a standard test of the significance of differences when the proportions of the top and bottom groups giving the keyed response on a single item are compared. This loss of meaning can be illustrated by observing that 114 out of 150 items presumably discriminated at the 0.01 level of significance or better.

THE DEPENDENCE PRONENESS SCALE - FORM ONE

The 45 items were selected when the results of at least two of the preceding item analysis procedures showed promise. The results are presented in the Appendix.

In the Appendix, the column to the left of the items indicates the arbitrary key for the dependent prone response. At the right of each item, the first column indicates the percentage difference of the high and low scoring criterion groups based on a standard item analysis of the 150 original items; this number is the number of students giving the keyed response out of 100 minus the similar number in the low scoring group. Whenever this number is 19 or higher, the difference is significant at the 0.01 level or lower using a standard test of significance, i.e., one based on binomial expansion.[1] Depending on the split, an 0.01 probability could occur even with a difference of only eight and at the 0.05 level, as low as six. Inspection of Table One indicates that all items except 5 and 18 were found to discriminate reasonably well.

The second, third, and fourth columns to the right of the items indicate the significance level of the three item analyses based respectively on (a) "total shift" scores in the tape recorded persuasion experiments, (b) "total countershift" scores in the same experiments, and (c) "teacher nomination" criterion groups of dependent and independent students identified by teachers. The last column to the right indicates those items which contribute the most to the I.Q. bias of the present 45 item scale; this bias is in the direction of high I.Q. students making the dependent response, except items 7, 18, and 42 which are reversed. Sex bias will be discussed in the next section.

APPLICATIONS OF THE DEPENDENCE PRONENESS TEST

This section will describe several successful applications of the dependence proneness test. Before going into the details, it should be made clear that further refinement of the test by more elaborate scaling procedures will be necessary and its usefulness at other age levels must be established.

The 45-item scale has the following characteristics when it is administered as part of the original 150-item battery. The mean for 646 males from 44 eighth grade classes, chosen at random in the Minneapolis - St. Paul urban area, is 27.30 with a standard deviation of 5.77. The mean for 644 females from the same classes is 30.68 with a standard deviation of 4.98. The sex differences are statistically significant below the 0.01 level of probability. The lower mean and higher standard deviation of the boys are consistent with our cultural expectancy of greater male independence and variability. It is clear that separate norms should be used to interpret the scores of boys and girls.

The reliability of the scale administered as 45 items was calculated by the analysis of variance technique suggested by Hoyt (18). The reliability coefficient is 0.68 resulting in an estimated standard error of measurement of 2.93 for a single score.

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[1] As previously indicated, the sampling distribution of this statistic is probably not well matched with the sampling distribution that would result from successive samples of the top and bottom 8% from a total N of 1,243. The error would be in the direction of rejecting the null hypothesis when it was true. Thus, our selection of items was based on the magnitude of the percentage difference.

The applications of the scale in separate studies provide additional information concerning the validity of the scale. These studies will be reported in greater detail elsewhere. First, Amidon (1) found that students scoring high on the scale are less likely to take an extreme position in an opinionnaire compared with students who scored low. This significant difference is consistent with the expectation that a low scoring student would be more likely to take an unequivocal position on a matter of opinion. Anderson (6) found that high dependent prone students prefer an ideal teacher who is "less directive" compared with low scoring students. This difference is significant at the 0.05 level. However, it is not as marked as the same sex difference, that is, girls prefer "less directive" teachers compared with boys, which was found at the 0.01 probability level.

In a larger study under contract with the U.S. Office of Education and not yet reported in the literature, it will be shown that high scoring students react differently compared with low scoring students in experimental learning situations. First, when two different teaching methods were employed in teaching geometry, there were significant differences in student achievement among treatments for the high scoring dependent prone students; this was much less true of low scoring students. Therefore, it is clear that the dependence proneness scale identified students whose achievement was different when intelligence and pre-learning achievement are controlled in a covariance design. These differences occurred in spite of being exposed to the same teacher and instructional materials. Second, students scoring high and low on dependence proneness exhibited predicted differences in separate measures of dependence in the classroom. For example, high scoring students indicated a desire for more support and approval during the learning sessions compared with low scoring students. These measures included asking for help from the teacher and the wish to show partially completed schoolwork in order to make sure the teacher thinks the student is "on the right track."

Along with these positive results some negative results also have appeared. Britton (10) asked nine teachers to nominate the two most dependent and the two most independent students in their classes, using procedures similar to those used in the initial item analysis; an intensive study of the 36 students failed to produce predicted differences. It seems likely that Britton's results may reflect most seriously on the validity of the teachers' nominations and also explains why only three out of 45 items discriminated at the 0.01 level in the original item analysis procedure.

One might also raise the question of whether it would be desirable to attempt a scale revision that would decrease or eliminate the present slight positive correlation of scale scores with measures of I.Q. In an analysis of several groups, product-moment correlation coefficients were found to range from +0.19 to +0.44, the correlation being higher for females than for males. The items that contribute the most to this correlation were identified by an item analysis based on high and low I.Q. criterion groups.

If one decides to reduce this correlation, it may be possible to alter items 3, 14, 15, 24, 25, 30, 39, and 40 which contribute most significantly to this correlation so that they are more like items 7, 18, and 42 which discriminate in the opposite direction. Any such changes would require additional scale analyses and revalidation procedures.

SUMMARY

The steps taken to develop a 45-item scale of dependence proneness have been outlined. The procedures used in the initial validation and cross validation indicate that the test identifies high scoring students who need more support and reassurance from the teacher as well as low scoring students whose classroom reactions are more independent of the teacher's behavior. Because the test identifies students who have different expectations of an ideal teacher and who respond differently to the methods of control used by teachers, it can provide greater experimental control in studies that contrast teaching methods.

The possibility that scores on this test will be related to measures of creativity is both plausible and intriguing. Getzels (15) suggests that creative students are more likely to provide unexpected or unusual responses to learning situations, a tendency he included as part of his measure of creativity. Our theory suggests that dependent prone students will try to make responses that they think the teacher wants. The consistent small positive correlation between I.Q. and dependence proneness supports Getzels (15) findings about "highly intelligent but low creative" students. It seems possible that students who score low on dependence proneness will have a stronger tendency toward creativity and, at the same time, be less restricted by teacher influence.

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APPENDIX

Item Analysis Results of the Forty-five Items Selected

Key	Item	% Diff.	Total Shift	Total C-Shift	Tchr Nom.	I.Q.
D	1. I hesitate to ask for help from others.	34	*	.05	*	*
A	2. I like to do things with my family.	35	*	.01	*	*
D	3. It's fun to try out ideas that others think are crazy	40	.05	.05	*	.01
A	4. I enjoy working with students who get good marks	32	*	.01	*	*
A	5. Students ought to be allowed to help one another with their school work.	1	.05	*	*	*
D	6. I don't need my friends' encouragement when I meet with failure	50	*	.05	*	.05
A	7. I never argue with my parents	24	*	.05	*	(.01
D	8. My folks usually have to ask me twice to do something.	60	*	.05	*	*
D	9. I don't like my friends to make a fuss over me when I'm sick.	27	*	.05	*	*
D	10. I seldom do "little extra things" at home just to please my parents.	35	*	.01	*	*
D	11. I want my friends to leave me alone when I am sad.	43	*	.01	*	*
D	12. I often disagree with my parents.	50	.10	.05	.05	*
A	13. I never do anything at home until I find out if it's okay.	71	*	.01	*	*
D	14. What others think of me does not bother me.	43	*	.05	.01	.01
D	15. Committee work is a waste of time.	40	*	.01	*	.01
D	16. I often disagree with what the class decides to do.	49	*	.01	*	*
A	17. You should always check to see if your parents approve of your friends.	62	*	.01	*	*

Key	Item	% Diff.	Total Shift	Total C-Shift	Tchr Nom.	I.Q.
A	18. A good friend will never disagree with you.	0	.05	*	.05	(.01)
D	19. I enjoy studying about things that my parents don't like.	44	*	.05	.1	*
A	20. I am apt to pass up something I want to do when others think that it isn't worth doing.	9	.01	*	*	*
D	21. I owe my greatest obligation to my family.	24	*	.05	*	.05
D	22. I don't like to show my friends how much I like them.	44	*	.05	*	*
D	23. I like to make my own decisions.	27	.01	*	*	*
D	24. My parents make unreasonable rules.	51	*	.01	.05	.01
D	25. Rules are made to be broken.	34	*	.05	*	.01
D	26. I would rather be left alone when I am in trouble.	43	.1	.05	*	.05
D	27. I would never tell on a student who has done something wrong.	41	*	.05	*	*
D	28. It annoys me when my friends tell me their troubles.	36	*	.05	*	.01
D	29. I dislike lending things to my friends.	35	*	.05	*	.05
D	30. I like people who ignore the feelings of others.	29	.05	.05	*	.01
D	31. I don't care whether or not I take home a good report card.	22	*	.01	*	*
D	32. I often seem to do things my parents don't like.	58	.1	.01	*	*
D	33. My parents treat me more like a child than a teen-ager.	36	*	.05	*	*
D	34. I don't care if other students say nice things about me.	33	.01	.05	*	.05
D	35. I sometimes break rules if it makes my friends like me.	45	.1	.05	*	*

Key	Item	Diff.	Shift	C-Shift	Nom.	I.Q.
D	36. I like to criticize people who are in charge.	36	*	.01	*	.05
A	37. I try never to disobey my parents.	57	.05	*	.01	*
A	38. I feel better avoiding a fight than trying to have my own way.	57	.01	.01	*	*
A	39. I like to follow instructions and to do what is expected of me.	48	.05	.01	*	.01
D	40. My family does not like what I intend to choose for my life work.	29	*	.01	*	.01
D	41. I often disagree with what the teacher says.	66	*	.05	*	*
A	42. In class it is best to go along with the majority even when you disagree.	25	*	.05	*	(.05)
D	43. I don't care if others are interested in the same things I am.	31	*	.001	*	*
D	44. It is not always best to have the majority make the decision.	15	.01	*	.05	*
D	45. The playground is a poor place to really get to know your friends.	38	.05	*	*	*

APPENDIX F

This entire appendix consists of a pre-publication draft of a manual for observers called "Interaction Analysis." This manual is used for observer training.

INTERACTION ANALYSIS IN THE CLASSROOM

A Manual for Observers

by

Ned A. Flanders

University of Minnesota

(Pre-publication Copy)

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At the University of Minnesota, 1955-57, the first steps were taken to establish relationships between an analysis of teacher-pupil communication and scores on a student attitude inventory. Most closely connected with these first efforts were Sulo Havumaki, Thomas Filson, Lowell Linnes, Ardyth Norem and Joyce Miller, who served as observers, helped to develop category definitions, observer ground rules, and some of the attitude items used in our tests. Work during this period was supported by the Laboratory for Research in Social Relations, a research department of the University of Minnesota which derived some of its support from a grant by the Carnegie Corporation.

During the Calendar year of 1957, further research was carried out in New Zealand. Acting as observers were Patricia Burns, Robert M. D. Harris, James Cappie, Don and Doug, who were education students at Victoria University, Wellington. The surnames of the latter two gentlemen are reported missing in interaction. Work during this period was supported by a Fulbright Research Fellowship and the resources of the New Zealand Council for Educational Research, Mr. George Parkyn, Director. The N.Z.C.E.R. is also supported in part by a grant from the Carnegie Corporation.

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INTERACTION ANALYSIS IN THE CLASSROOM

A Manual for Observers

The Problem

The spontaneous behavior of a teacher is so complex and variable than an accurate description of it is most difficult to obtain. Even trained observers struggle with the same biases that distort the testimony of witnesses at the scene of an accident. Too often an observer's preconceptions of what he thinks should happen creates a screen through which the perceptions of some behaviors can pass and are noticed and other behaviors cannot pass and are ignored. Interaction analysis is an observation procedure designed to minimize these difficulties, permit a systematic record of spontaneous acts, and scrutinize the process of instruction by taking into account each small bit of interaction. If there is ever to be a theory of instruction, a tool such as interaction analysis will be necessary to test its principles.

This report describes the current procedures of interaction analysis that are used at the University of Minnesota to study teacher influence in the classroom. The antecedent research as well as the difficulties encountered during the six years of development will be largely ignored. The topics to be discussed are: (a) the purpose of interaction analysis; (b) the categories and procedures; (c) the problems of observer training and reliability; (d) the interpretation of interaction matrices; (e) the statistical problems of comparing matrices; and (f) the possible applications in education.

The Purpose of Interaction Analysis in the Classroom

Not all systems of interaction analysis have the same purpose. The Minnesota system is particularly concerned with analyzing the influence pattern of the teacher. This might be considered to be a bias, but it is a bias of purpose and interest. Our purpose is to record a series of acts in terms of predetermined concepts. The concepts in this case refer to the teacher's control of the students' freedom of action. Our interest is to distinguish those acts of the teacher that increase the students' freedom of action from those acts that decrease the students' freedom of action and to keep a record of both. The system of categories used forms a screen in front of the observer's eyes so that those acts which result in compliance are sharply separated from those that invite more creative and voluntary participation, while certain aspects of subject matter are ignored.

Bales (5) and his colleagues have developed a system of interaction analysis designed to analyze communication in small problem solving groups. They have developed the most extensive program for training observers, have identified some of the unique statistical problems involved, and have explored observer training as a technique for improving participation in groups. The studies of H. H. Anderson, *et al.* (1,2,3,4) first applied a modified form of interaction analysis to classroom communication; Withall (11) reduced the total number of categories used by Anderson; and Mitzel and Rabinowitz (8) have made additional adaptations of the Withall categories. These studies have all contributed to the Minnesota system. More recently Smith, Aschner, and Meux (9) at Illinois have begun the important but arduous task of analyzing classroom interaction in terms of the logic of discourse. In spite of the oversimplification, one can say that the focus of the Illinois project is on the ideational aspects of classroom communication while the earlier studies, as well as the Minnesota studies, have been concerned with the teacher's control of classroom communication. Wright (12) apparently stands somewhere between these two points of view in her analysis of communication in mathematics classes.

Since observation categories involve concepts which are, in turn, related to some theory, interaction analysis is a process of abstracting the intent of an act from the act itself. In the Minnesota system the observer must judge whether an *act* increases or decreases the students' freedom of action, he is not necessarily concerned with the conscious intent of the teacher. In fact, what the teacher has in mind when he communicates with students may be inconsistent with the observer's judgment of intent that is made within the limited number of categories available.

Interaction analysis is concerned primarily with verbal behavior. This can be observed with higher reliability than most nonverbal behavior. The assumption is made that the verbal behavior of an individual is an adequate sample of his total behavior. In the classroom we must assume that the verbal statements of a teacher are consistent with his nonverbal gestures, in fact, his total behavior. This assumption cannot easily be tested since it would take too long a period to develop reliable measures of nonverbal behavior. A feeling for what is involved can readily be obtained by closing your eyes when a teacher is talking, having a friend keep you informed concerning "happy," "neutral," and "angry" expressions or gestures, and then deciding whether your friend's observations are consistent with your interpretation of the teacher's statements. The assumption seems reasonable in terms of our experience at Minnesota.

The Categories and Procedure of the Minnesota System

The Procedure:--The observer sits in the classroom in the best position to hear and see the participants. At the end of each three-second period, he decides which category best represents the communication events just completed. He writes this category number down while simultaneously assessing communication in the next period, and continues at a rate of 20 to 25 observations per minute, keeping his tempo as steady as possible. His notes are merely a sequence of numbers written in a column, top to bottom, so that the original sequence of events is preserved. Occasionally marginal notes are used to explain the class formation or any unusual circumstances. When there is a major change in class formation, the communication pattern, or the subject under discussion, a double line is drawn and the time indicated. As soon as the total observation is completed, he retires to a nearby room and completes a general description of each separate activity period indicated by the double lines, including the nature of the activities, the class formation, and the position of the teacher. The observer also notes any additional facts that seem pertinent to an adequate interpretation and recall of the total observation period. These original comments are used in the tabulation of the interaction data.

The Categories:--There are ten categories in the system. Seven are assigned to teacher talk and two to student talk. The tenth category classifies pauses, short periods of silence and talk that is confusing or noisy. The category system is outlined on page 5.

The seven categories assigned to teacher talk are divided into indirect and direct influence. Categories one through four represent indirect influence, categories five, six and seven represent direct influence.

Indirect influence encourages student participation and thereby increases his freedom of action. To ask a question, category four, is an invitation to participate and express ideas, opinions, or facts.

It is true that a question can leave very little freedom of action, but at least the student can refuse to answer, which involves more freedom than passive listening. The more general a question, the greater the opportunity to assert one's own ideas.

In category three, the teacher accepts, clarifies, or uses constructively the ideas and opinions of students. The students are rewarded and encouraged to further participation. Often teachers do not hear what a student says; to acknowledge and make use of an idea is a powerful form of recognition.

To praise or encourage student participation, category two, is to solicit even more participation.

The ability to use the feeling tone of a student constructively, to react to feeling and clarify it, category one, is a rare skill. Teachers with this skill can often mobilize positive feelings in motivation and successfully control negative feelings that might otherwise get out of hand.

All of these actions tend to increase student participation, to reward student participation, and to give students the opportunity to become more influential. The net effect is greater freedom of action for the students.

Direct influence increases the active control of the teacher and often stimulates over conformity in behavior. To lecture, category five, focuses the attention of the students on ideas chosen by the teacher. To give directions or commands, category six, is to direct the activities of the class with the intent of obtaining compliance.

Category seven refers to criticizing student behavior or justifying the teacher's use of authority. These actions concentrate authority in the hands of the teacher.

Direct influence tends to increase teacher participation and establish restraints to student behavior. The ensuing restriction of freedom may occur in terms of compliance to the teacher or be an adjustment to the requirements of problem solving activities. The net effect is less freedom of action for the students.

The division of student talk into categories eight and nine provides an automatic check on freedom of student action within the system of categories. Usually, but not always, an excessive or above average pattern of direct teacher influence is associated with less student talk and the talk that does occur is usually in response to the teacher--category eight. An above average indirect pattern is usually associated with more student talk and this talk will have a higher proportion of self-initiated talk--category nine.

The use of only two categories to record all kinds of student talk neglects a great deal of information, but the major purpose of these categories is the analysis of teacher influence. The greatest information will accrue from observation if category nine is used sparingly and only on those occasions when the communication is truly student initiated.

For example, a student answering the specific question of a teacher, giving the answer to a problem, or reading material is obviously category eight. Even a student giving an oral report is restricted to an outline and except for unusual circumstances is probably responding to teacher supported restraints.

Category nine should be used to indicate the expression of the student's own ideas in spontaneous interaction. General questions are often a clue that a student may be initiating his own ideas. When a teacher calls on a student who voluntarily raised his hand to speak and asks, "Have you anything to add, Robert?", the chances are that the use of category nine is correct.

The purpose of category ten is to record pauses, silences and periods of confusion as they occur during classroom interaction. It is not intended to record longer periods of silence or confusion, for example, those that are more than two minutes. The continuous use of this category for long periods of silence serves no useful purpose.

The system of categories is designed for situations in which the teacher and the students are actively discussing schoolwork. It is an inappropriate tool when the verbal communication is discontinuous, separated by fairly long periods of silence, when one person is engaged in prolonged lecturing, or is reading aloud to the class. In situations in which two-way communication does not exist and is not likely to exist, the observer should stop, make a note of the exact time at which spontaneous interaction lapsed and the reasons for the interruption. The observer must remain alert to the resumption of spontaneous interaction.

Marking Activity Periods:--The early research of Anderson, *et al.* (3) and Withall (11) made use of interaction analysis to identify a unique profile for a teacher at work with his class. The strategy of these earlier studies was that if all teacher acts were classified over a reasonably long period of time, a stable profile would emerge from which certain generalizations could be made about the quality of the teacher's influence.

Teacher influence, however, is not stable even though one can identify a stable profile. It is more realistic to think of it as a pattern that is constantly changing over time. The most effective teachers, in fact, have a large repertoire of behaviors and systematic observation shows that they can present many different influence patterns.

CATEGORIES FOR INTERACTION ANALYSIS

Minnesota, 1959

TEACHER TALK	INDIRECT INFLUENCE	1.*	ACCEPTS FEELING: accepts and clarifies the feeling tone of the students in a nonthreatening manner. Feelings may be positive or negative. Predicting or recalling feelings are included.
		2.*	PRAISES OR ENCOURAGES: praises or encourages student action or behavior. Jokes that release tension, not at the expense of another individual, nodding head or saying, "um hm?" or "go on" are included.
		3.*	ACCEPTS OR USES IDEAS OF STUDENT: clarifying, building, or developing ideas suggested by a student. As teacher brings more of his own ideas into play, shift to category five.
		4.*	ASKS QUESTIONS: asking a question about content or procedure with the intent that a student answer.
	DIRECT INFLUENCE	5.*	LECTURING: giving facts or opinions about content or procedure; expressing his own ideas, asking rhetorical questions.
		6.*	GIVING DIRECTIONS: directions, commands, or orders to which a student is expected to comply.
		7.*	CRITICIZING OR JUSTIFYING AUTHORITY: statements intended to change student behavior from nonacceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.
STUDENT TALK		8.*	STUDENT TALK--RESPONSE: talk by students in response to teacher. Teacher initiates the contact or solicits student statement.
		9.*	STUDENT TALK--INITIATION: talk by students which they initiate. If "calling on" student is only to indicate who may talk next, observer must decide whether student wanted to talk. If he did, use this category.
		10.*	SILENCE OR CONFUSION: pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.

*There is NO scale implied by these numbers. Each number is classificatory, it designates a particular kind of communication event. To write these numbers down during observation is to enumerate, not to judge a position on a scale.

The identification of activity periods is one way that flexibility can be studied. In effect, a second system of categories is superimposed on the ten interaction categories; this second system is likely to be different in each research study. For example, it may be sufficient in a study of high school mathematics classes to indicate periods of (a) settling down to work, (b) introducing new material, (c) teacher directed discussion or work on material that is not new, (d) supervision and direction of individual seatwork, and (e) periods of evaluation in which homework and test results are discussed.

In an elementary classroom, it would be reasonable to keep interaction data collected during show-and-tell separate from reading instruction, and in turn from arithmetic, music, games, penmanship, etc.

If interaction analysis is to be used to discover whether a teacher's pattern of influence in planning work with students is different, for example, from his influence pattern while supervising work already planned, then even finer discriminations would be necessary to identify the boundaries of the required time periods.

One way to develop observer sensitivity to these different activity periods is to train them to draw a double line whenever there is a change in the class formation, the communication pattern, the subject matter to be learned, or in the presumed purpose of instruction. After the classroom visit is completed, the observer can use his double lines and marginal notes to recreate a brief chronology of the classroom activities. Interaction data gathered by this procedure can be grouped in a variety of ways for special comparisons.

No matter whether one is discussing a set of categories for interaction analysis or a set of categories for classifying activity periods, there are two requirements that must be satisfied in order to make generalizations about total class interaction. First, the system should be designed to include all possible events, that is, the categories should be totally inclusive.

Second, a single event must be recorded in one, and only one, category so that the categories can be considered mutually exclusive.

Any system of observation that fails to meet the first requirement is selective and the data are not representative of all the events that occurred. Failure to meet the second requirement means that the enumeration of an event is no longer consistent and the comparison of category frequencies becomes meaningless or at least biased in some unknown way.

The Problems of Observer Training and Reliability

The problem of observer training is twofold: first, converting men into machines, and second, keeping them in that condition while they are observing. The ideal observer team is a group of like-minded individuals who will respond consistently with the same category number when presented with the same communication events. The problem is twofold because once training has produced an acceptable level of reliability, it can still deteriorate due to the unending variety of judgments that arise and require consistent treatment. Apparently no system of training can anticipate all of the judgments that an observer will be required to make. Since most observer teams must maintain their reliability over periods of time that may be as long as three to nine months, new judgments must be discussed so that all observers treat them consistently.

Individuals differ in their ability to become reliable observers. We have found that successful teaching experience, particularly in the elementary field, is a strong recommendation. Others who have become successful observers at Minnesota have had counseling experience, a broad background in social psychology, or experience as observers in some other system of interaction analysis.

Training Procedures:--After memorizing the categories, training begins with tape recordings of classroom interaction. It is desirable to have a variety of training tapes that provide unusual examples of indirect or direct influence patterns and to have an exact category distribution for each tape. Observer trainees seem to learn faster, working with tapes, in teams of two or more. They can start and stop the playback to discuss each classification; an experienced observer on hand is helpful and frequent but short straight runs without interruption should be carried out to develop a consistent tempo.

Six to ten hours of preliminary training with tapes is necessary before moving into "live" classrooms.

During the preliminary training it becomes apparent that classroom observation involves judgments that are not as objective, automatic, and "black-and-white" as the trainees originally thought. They soon learn that reliable observation requires consideration of the total social situation being observed in order to understand the individual acts being classified. Trainees also discover the need for ground rules in order to be consistent when choices occur. Some of these ground rules will now be discussed.

First, when there is a choice of two or more acts in a three second time period, always record the act represented by the category most distant numerically from category five, with the exception of category ten. This rule can be restated: always maximize information by choosing the least frequently occuring category (except ten), when there is a choice.

Second, the trained observer is in the best position to judge whether the teacher is, in general, restricting or expanding the freedom of action of the students; if he feels that the pattern at the moment is restrictive, he is cautious in the use of the indirect categories; if he feels that the pattern at the moment expands freedom, he is cautious in the use of direct categories; but he remains alert to a shift in momentary patterns by remaining alert to the total social situation.

At first, this ground rule seems to be an invitation to biased observation, yet there is a theory of the "unbiased, biased observer." The observer is biased in the sense that his categorization must be consistent with his general assessment of the teacher's intent for a given sequence of action. He is unbiased in that he remains open to all evidence that the general intent of the teacher may be changing.

During preliminary training, the problem of distinguishing shifts from five to three and three to five usually arises. When this problem is recognized, it is appropriate to introduce the second ground rule and discuss how it may be inconsistent with the first ground rule. For example, a teacher does, in fact, repeat what a student has just said, but this appears to be merely a verbal habit and not evidence of a true acceptance and development of the students' ideas. In this situation, how does one use category five and three? The answer is never fixed or final, but the observer must learn to be skeptical of verbal habits which are often unreliable cues compared with the total time the teacher talks, the nature of the learning activities, and other more general evidence.

Another problem will arise concerning the use of category two. A teacher may have a verbal habit of responding to nearly all student statements with "right" or "good" which must be distinguished from true praise. True praise must get through to the student and must provide reward and encouragement; this cannot be accomplished by a verbal habit alone.

After preliminary training with tape recordings, the trainees start first hand classroom experience. During this second phase of training the presence of an experienced trainer is essential. A soundproof observation booth is helpful so that the observers can stop and can discuss their observations whenever they wish. If no booth is available, a tape recording that the observation team can go over as soon as possible may serve as an alternative.

Direct classroom observation provides "presence" that is essential to distinguishing between categories eight and nine. A host of problems arise at this point. For example, the teacher asks a question, ten hands go up volunteering an answer. If the teacher calls on a student whose hand is not raised, his contribution is clearly an eight. But if the teacher calls on a student whose hand is raised, is this also an eight? Suppose a student's answer has no content relation, or very little, with the teacher's question. How does this affect the use of categories eight and nine? Suppose the student answers the teacher's question and then goes on to develop another line of thought, how is this to be classified?

We have found it impossible to establish a simple ground rule such as--if the hand is up it is always a nine. In some instances of teacher dominated high speed drill in which the freedom of action of the student is obviously restricted, the teacher's questions are more like sixes than fours, and the student responses are clearly eights in spite of hand raising. Often when the teacher is lecturing, questions are merely used to check up on the student's understanding of what the teacher has said and again, in spite of the hand raising, the classification of eight seems more appropriate than nine. The best rule about categories eight and nine is to have a clear answer to the question, "How is the student showing his initiative?", before assigning a nine.

When the observer can answer the HOW question and explain (to himself) the method used by the student to show his initiative, then the total number of nine tallies decreases and they become a better index of student freedom of action.

Another ground rule about student talk applies during spontaneous student-to-student communication, usually shown as a series of nines. We have found it useful to insert a ten in the sequence of nines to indicate when one student stopped and another began. These tens must be slipped in quickly as an extra observation when the talk of different students is not naturally separated by a three second pause.

In some lecture situations a teacher uses a question as criticism, which raises a question about the use of categories four and seven. For example, the teacher sees Jane whispering to Mary and promptly asks Jane a question. (Jane frequently says, "I'm sorry, I didn't hear you.") When it is clear to the observer that both the teacher and Jane recognize the intent of criticism, the teacher's statement is properly classified as seven.

No matter how extensive the training, creative teachers will present sequences of behavior that raise new problems of categorization. After five years of experience, for example, the writer was stumped by a teacher who spontaneously started to role play a student in the library using the general catalog. The teacher wanted to summarize a lesson in how to use the library for reference purposes. Her actions were both humorous and informative. She asked a student what topic he expected to look up, during the class's impending first library visit, and pretended to thumb through a series of cards, reading imaginary topics, some of which were very funny. "Oh dear!" she said, "There is nothing on crocodiles. What shall I do now?" "Try reptiles," said a brighter student. As the little dramatization developed, the class learned how to make a cross reference. After discussing the incident with the observer team, we decided that the teacher's primary intent was to develop a problem in terms of the students' experience, that the teacher was working with an anticipated student problem, and that the humor encouraged both present and future participation. The decision was to classify most of the role playing in category three with the humorous parts in category two.

Consistent observation by a team requires group training, discussion of common ground rules, each observer's understanding of his own unique biases, and regular meetings after training to discuss unusual categorization problems. The next section explains an informal statistic that can be used to estimate reliability. A discussion of the more formal analysis of interaction data will be found in subsequent sections of this manual.

Estimating reliability:--A method of estimating reliability should be as simple and quick to calculate as possible. Bales (5, p. 104) proposes an adaptation of Chi-square which was found to be less appropriate for our purposes than was Scott's (10) coefficient. Scott's method is unaffected by low frequencies, can be adapted to per cent figures, can be estimated more rapidly in the field, and is more sensitive at higher levels of reliability.

Scott calls his coefficient "pi" and it is determined by the two formulae below.

$$\pi = \frac{P_o - P_e}{1 - P_e} \qquad (1)$$

P_o is the proportion of agreement, and P_e is the proportion of agreement expected by chance which is found by squaring the proportion of tallies in each category and summing these over all categories.

$$P_e = \sum_{i=1}^{k} p_i^2 \qquad (2)$$

In formula two there are k categories and p_i is the proportion of tallies falling into each category. π, in formula one, can be expressed in words as the amount that two observers exceeded chance agreement divided by the amount that perfect agreement exceeds chance.

In estimating reliability during training, problems of tempo or the speed of tallying are less important than the proportional distribution within the categories. Sooner or later in the training cycle observers settle down to the required tempo of 20 to 25 tallies per minute. Effective training, however, requires immediate feedback regarding category discriminations, so we chose to modify Scott's method by converting tallies into per cent figures and developing a graphical method for estimating P_e from the size of the two largest categories. The resulting short-cut method can be quickly estimated in the field by the use of a pocket slide rule.

The procedure we now use is as follows. Step One: the original tallies are recorded as "hash marks" (𝍸 ||, etc.) for quick summing on a sheet containing ten columns, one for each category.

Step Two: add column totals, divide each by the grand total, and multiply by 100 to convert to per cent.

Step Three: while one observer finds the total per cent disagreement by subtracting the per cent figures corresponding to each category--summed over all categories, the other observer estimates P_e by entering Figure One with the largest and second largest categories as determined by either distribution or averaged from both.

Step Four: P_o is determined by subtracting the total per cent disagreement from 100.

Step Five: π is found by entering Figure Two (page 12) with P_o and P_e.

The tallies of two trainees after about ten hours of training are shown in Table One (page 11), columns two and three. The proportion of tallies in each category is expressed as a per cent in columns four and five. The differences between columns four and five are shown in column six and the sum of this column is the per cent disagreement. Column seven, consisting of the average per cent falling in each category squared, is not normally calculated by observer trainees, but it is included here as the most accurate estimate of P_e; in this case $P_e = 23.7$ and is shown as the sum of column seven. This number can be compared with two estimates of P_e that the observer trainees would obtain by using Figure One (page 12).

Table One
Calculating Reliability by Scott's Method
Using Per Cent*

Category (1)	Observer A (2)	Observer B (3)	% A (4)	% B (5)	% Diff. (6)	(Ave. %)^2 (7)
1	12	9	3.3	2.1	1.2	.072
2	3	4	0.8	0.9	0.1	.008
3	24	34	6.5	8.1	1.6	.403
4	25	25	6.8	5.9	0.9	.530
5	76	97	20.7	23.1	2.4	4.840
6	3	7	0.8	1.8	1.0	.017
7	3	4	0.8	0.9	0.1	.007
8	151	160	41.2	38.0	3.2	15.500
9	51	59	13.9	14.1	0.3	1.960
10	19	22	5.4	5.2	0.2	.280
Totals	361	421	100.2	100.1	11.0	23.617

*The figures in columns 4, 5, & 7 were found by using a pocket slide rule.

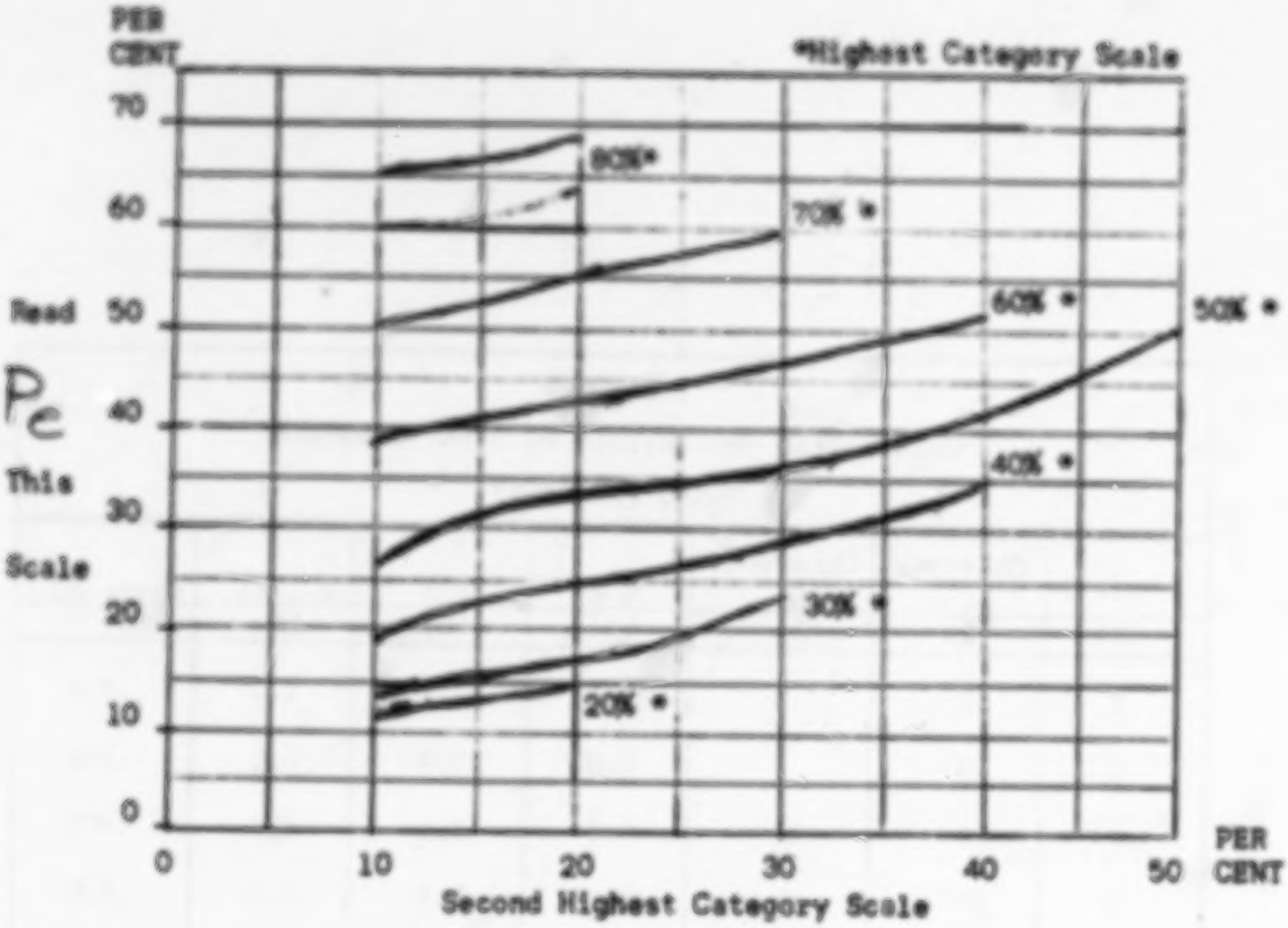

Figure One

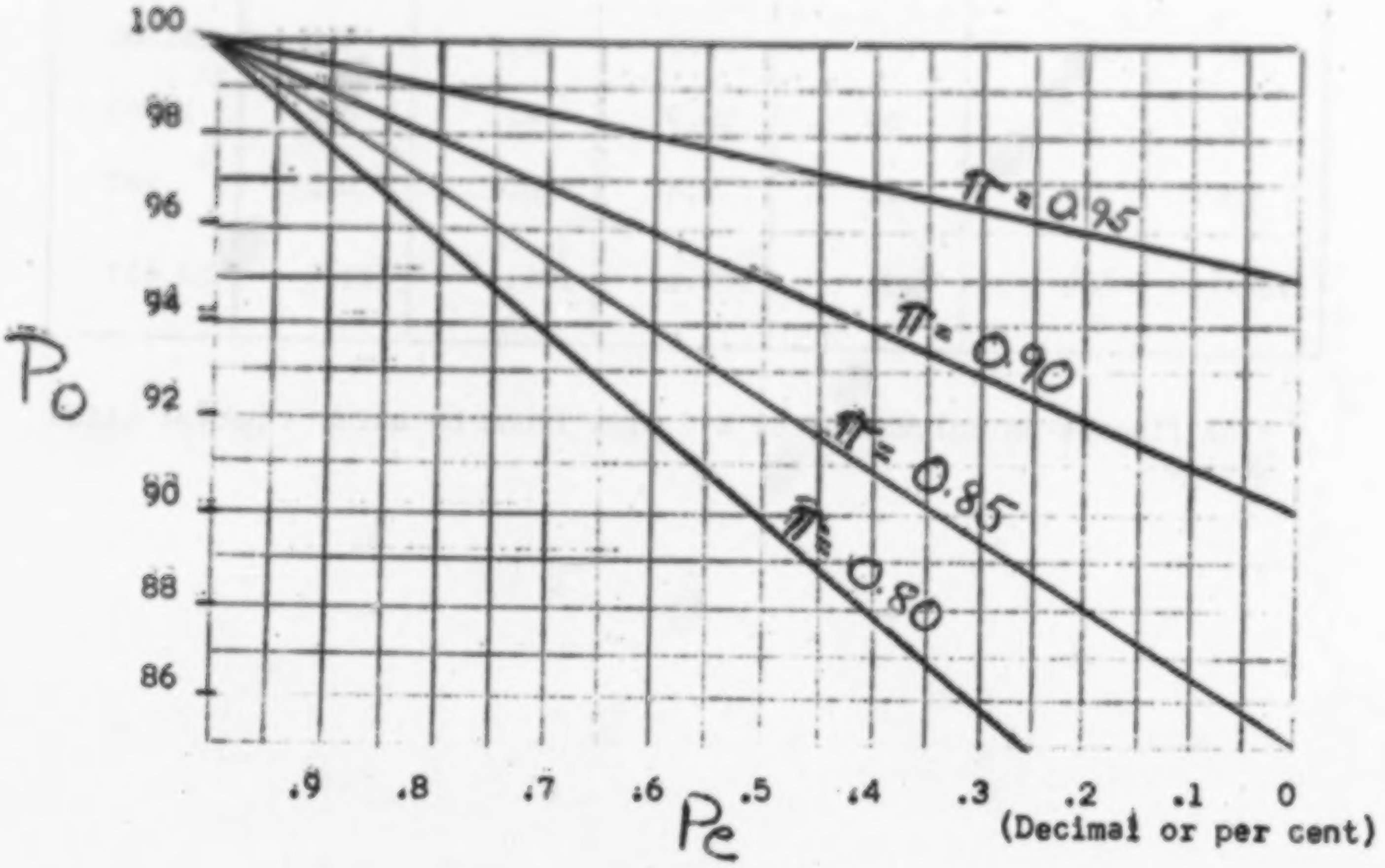

Figure Two

First, if Trainee A entered Figure One with his two highest categories, 41% and 21%, he would estimate P_e as 25+ %. Second, if Trainee B made the same estimate with his highest, 38% and 23%, his estimate would be 24%.

Below are three calculations of π using these three estimates of P_e.

$$\pi = \frac{P_o - P_e}{100 - P_e} = \frac{[100-11] - 23.6}{100-23.6} =$$

$$\frac{65.4}{76.4} = 0.855 \quad P_e \text{ estimated from column 7.}$$

$$\pi = \frac{P_o - P_e}{100 - P_e} = \frac{[100-11] - 25}{100-25} =$$

$$\frac{64}{75} = 0.853 \quad P_e \text{ estimated by Trainee A.}$$

$$\pi = \frac{P_o - P_e}{100 - P_e} = \frac{[100-11] - 24}{100-24} =$$

$$\frac{65}{76} = 0.854 \quad P_e \text{ estimated by Trainee B.}$$

These three estimates are quite close and show that a graphical-slide rule method of estimation is quite adequate for training purposes. (Reading a pocket slide rule to three significant figures is part of the "art" of observing.)

Scott's reliability coefficient as we use it, is quite arbitrary. It is legitimate to ask about the approximate error involved when observers maintain a coefficient of 0.85 or higher. One way to illustrate all errors[1] is shown in Table Two (page 14.)

In rows one through seven the errors are shown separately for each category in the numerator and the total judgments are shown in the denominator. Row eight shows the per cent error of the fraction just above in row seven. The per cent of total judgments falling in each category is shown in row nine, based on the grand total, 10,735. Row ten is a crude estimate of the limits of error for each category.

The limits are estimated as follows: for category one, two-thirds (approximately 63.7%) of 0.10 (row nine) is 0.06 which can be expressed as ± 0.03; for category two, 14.4% of 1.17 is about 0.18, expressed as ± 0.09 and so on.

An inspection of row eight indicates that error decreases with increasing frequency of a category. The especially high error of category seven is caused by the poor performance of April 10th when one observer used a tape recording without the benefit of seeing the original interaction. Table Two gives ample evidence that this system of interaction analysis is far from a precision instrument, but when the combined error limits of any two categories is small compared with the difference between the two categories, it is proper to proceed with statistical tests of significance.

A continuous estimate of observer error could be obtained if two observers were always present at each observation. Such duplication is costly in both time and money; with proper training and control, observer teams can maintain reliability with weekly discussions and bi-monthly reliability checks. A Scott coefficient of 0.85 or higher is a reasonable level of performance.

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[1] There are many different types of error: (a) omission; (b) heard it, but misclassified it; (c) failed to record it--dropped pencil; etc.

Table Two

Errors for Two Observers during a Four Month Period

Row	Date of Observation	Category*									Total	π
		1	2	3	4	5	6	7	8&9	10		
1	January 6	$\frac{1}{1}$	$\frac{6}{30}$	$\frac{1}{33}$	$\frac{11}{105}$	$\frac{26}{816}$	$\frac{6}{28}$	$\frac{3}{15}$	$\frac{12}{154}$	$\frac{6}{30}$	$\frac{72}{1,212}$	.88
2	January 12	$\frac{1}{1}$	$\frac{4}{40}$	$\frac{4}{36}$	$\frac{1}{187}$	$\frac{50}{884}$	$\frac{1}{13}$	$\frac{1}{3}$	$\frac{3}{361}$	$\frac{9}{76}$	$\frac{74}{1,601}$	.92
3	April 2	$\frac{4}{8}$	$\frac{3}{11}$	$\frac{7}{67}$	$\frac{3}{107}$	$\frac{4}{516}$	$\frac{0}{12}$	$\frac{1}{5}$	$\frac{2}{367}$	$\frac{5}{23}$	$\frac{29}{1,116}$	.96
4	April 10**	$\frac{0}{0}$	$\frac{0}{10}$	$\frac{4}{26}$	$\frac{5}{291}$	$\frac{86}{906}$	$\frac{24}{294}$	$\frac{26}{82}$	$\frac{24}{566}$	$\frac{12}{42}$	$\frac{181}{2,217}$	.88
5	May 1	$\frac{0}{0}$	$\frac{3}{13}$	$\frac{0}{18}$	$\frac{7}{243}$	$\frac{33}{1209}$	$\frac{5}{283}$	$\frac{3}{13}$	$\frac{7}{405}$	$\frac{5}{62}$	$\frac{63}{2,246}$	.96
6	May 29	$\frac{1}{1}$	$\frac{2}{21}$	$\frac{8}{8}$	$\frac{33}{273}$	$\frac{11}{727}$	$\frac{12}{62}$	$\frac{0}{2}$	$\frac{3}{1168}$	$\frac{9}{81}$	$\frac{79}{2,343}$	.94
7	Total Errors Tallies	$\frac{7}{11}$	$\frac{18}{125}$	$\frac{24}{188}$	$\frac{60}{1206}$	$\frac{210}{5058}$	$\frac{48}{692}$	$\frac{34}{120}$	$\frac{51}{3021}$	$\frac{46}{314}$	$\frac{498}{10,735}$	
8	% Error	63.7	14.4	12.8	5.0	4.1	6.9	28.3	1.7	14.6	4.66	
9	% Category	0.10	1.17	1.75	11.24	47.20	6.45	1.12	28.17	2.32		
10	Category Limits	±0.03	±0.09	±0.11	±0.23	±0.97	±0.22	±0.16	±0.24	±0.21		

*Categories 8 and 9 were not separated in 1956, all student talk appeared in one category.

**Reliability check "live" vs. tape recording.

The Tabulation and Interpretation of Interaction Matrices

The communication events that occur in a classroom are interdependent and as soon as the first statement is made a better than average prediction can be made about the next event. The very nature of communication places an especially high loading on category five because, more than anything else, a teacher communicates information. The unequal probabilities averaged over a long period of interaction can be estimated by dividing the percentages in row nine, Table Two, by 100. To illustrate, for category five, p = 0.47 and for category one, p = 0.01.

Not only are the probabilities unequal within the ten categories, but these same probabilities keep changing with each event. When a teacher is lecturing, the probability that a student will talk next is quite low; when a teacher asks a question, the probability that a student will talk next suddenly increases. The vexing statistical problems that are caused by this interdependence will be discussed in greater detail in the next section. It is enough to say here that the solution to the statistical problems makes use of 10 X 10 matrices and the purpose of this section is to explain how interaction data are tabulated in these matrices and how data thus tabulated can be interpreted.

Tabulating a Matrix:--A trained observer records his data as a series of numbers instead of the hash marks used in early training. For example, the school bell rings and the following interaction occurs. The numbers written down by the observer are indicated in parentheses.

Teacher: "Class! The bell has rung. May I have your attention please! (6)

During the next three seconds talking and noise diminish. (10)

Teacher: "Jimmy, we are all waiting for you." (7) Pause.

Teacher: "Now, today we are going to have a very pleasant surprise, (5) and I think you will all find it very exciting and interesting. (1) Have any of you heard anything about what we are going to do? (4)

Pupil: "I think we are going on a trip in the bus that's out in front." (8)

Teacher: "Oh! You've found out! How did you learn about our trip?" (4) Etc.

By now the observer has written down 6, 10, 7, 5, 1, 4, 8, and 4. As the interaction proceeds the observer will continue to write down numbers. To tabulate these observations in a 10 X 10 matrix, the first step is to make sure that the entire series begins and ends with the same number. The convention we use is to add a ten to the beginning and end of the series, unless the ten is already present. Our series now becomes 10, 6, 10, 7, 5, 1, 4, 8, 4 and 10. This procedure is followed in order to produce a finished matrix in which the sum of column one equals the sum of row one, the sum of column two equals the sum of row two, in short, so that the sums of the columns and rows are equal, respectively.

The number ten is used because it will affect the interpretation of teacher influence the least. One of our less sympathetic critics suggested, however, that this convention is necessary in order to begin and end an observation in confusion.

Second

FIRST

	1	2	3	4	5	6	7	8	9	10	
1				I							1
2											0
3											0
4								I		I	2
5	I										1
6										I	1
7					I						1
8				I							1
9											0
10						I	I				2
	1	0	0	2	1	1	1	1	0	2	9

Table Three

The numbers are tallied in the matrix one pair at a time. The column is used for the second number, the row is used for the first number. The first pair is 10-6: the tally is placed in the row ten column six cell. The second pair is 6-10: tally this in the row six column ten cell. The third pair is 10-7, the fourth pair is 7-5, and so on. Each pair overlaps with the next and the total number of observations, "N", always will be tabulated by N - 1 tallies in the matrix. In this case we started a series of ten numbers and the series produced nine tallies in the matrix. The tabulation is shown in Table Three.

Each matrix should include all of the observations for the elapsed time of a single activity period, or all the numbers between a double line.

For example, given one hour's observation in a secondary class, there may be a separate matrix for each of the following time periods: first, five minutes of routine announcements, getting settled down, taking the roll, etc.; second, fifteen minutes of going over homework and reviewing the assignment of yesterday; third, fifteen minutes for the introduction of some new material and discussion of this material; fourth, ten minutes to discuss one student's progress on a special assignment; and fifth, eight minutes of starting on tomorrow's homework with the teacher giving help to individual students.

A total matrix for the 53 minute class may also be desirable. In an elementary school, natural units of activity would also be tabulated in separate matrices. A particular research design may require combining matrices of the same activity for subsequent analyses.

Some thought must be given to the cost of matrix tabulation. When this work is done by a clerk, it frequently involves considerable time lost due to errors. As soon as a matrix is tabulated, the sums of the respective columns and rows must be compared. If an error has been made, the respective sums will not check.

The error is most likely due to tallying in the wrong cell, but it might be due to not beginning and ending the sequence with the conventional ten.

At the University of Minnesota, clerks have achieved speeds of from 300 to 600 tallies per hour in producing balanced matrices. The slower speeds are due to correcting errors.

Automation is possible for tabulating matrices. Two systems are now being investigated. The first would make use of I.B.M. mark-sense cards on which the observer would make his original observations. These can be fed through an automatic punch and then programmed to tabulate matrices.

A second system can be designed around a special apparatus that makes use of electrical counters, 100 for the matrix and ten additional for column totals, for which the necessary circuits have already been designed.

An extended research program produces tremendous quantities of data; automation is almost a necessity.

The Interpretation of Matrices:--Perhaps the most exciting part of this system of observation is the large number of interpretations that can be made from a matrix that are directly relevant to assessing teacher influence. Some of these interpretations will now be mentioned.

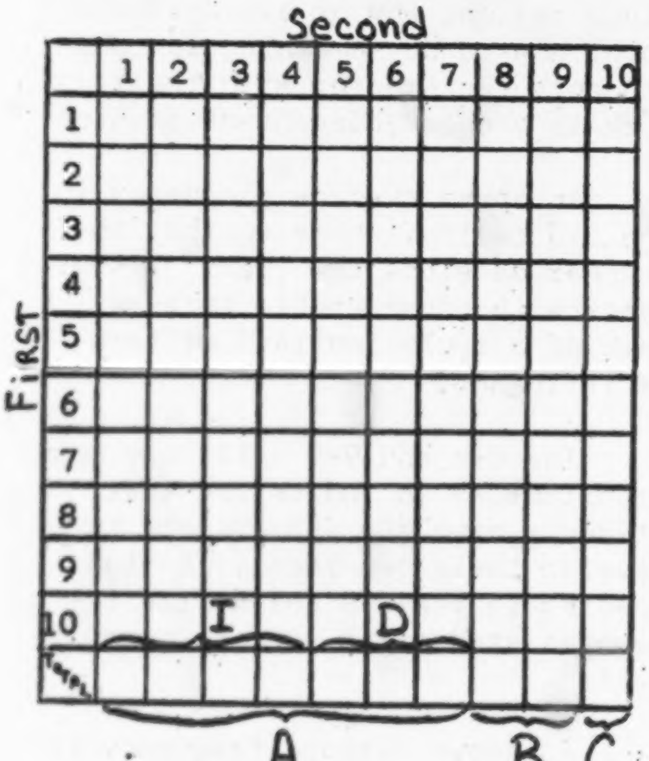

Table Four

Table Four indicates the basic totals that give a general picture of interaction for the period of observation. The proportion of tallies in A, B, and C indicates how much the teacher talks, the students talk, and the time spent in silence or confusion.

One can expect C to vary from a mere trace to about ten per cent. Student talk, B, typically varies from 25 to 40 per cent. The per cent of teacher talk, A, varies from about 50 to 80. These ranges apply to totals from a minimum of six hours observation. It is possible, of course, to record an hour of exclusive teacher talk, student talk or silence, but this system of observation would be inappropriate to the analysis of such interaction.

The total teacher talk, A, can be divided into I--or indirect influence, and D--or direct influence. An I/D ratio, first suggested by Anderson, et al. (1,2,3,4), can be quickly calculated from the column totals. However, we have found it more consistent to express the same information by simply referring to the per cent of indirect or direct tallies of the total in columns one through seven, see A, Table 4.

Another method of calculating an I/D ratio is to make use of categories 1, 2, and 3 for the numerator I and use categories 6 and 7 for the denominator D. This ratio is more independent of the subject matter emphasis, since categories four and five are not used.

The use of a ratio for characterizing a pattern of teacher influence is sometimes useful as a crude classifying procedure in the early phases of statistical analysis in studies involving fifteen or more teachers. A simple ratio, however, provides very little information. A matrix will provide a more complete explanation of how several influence patterns may differ, whether it represents a single teacher or a group of teachers.

		Second									
		1	2	3	4	5	6	7	8	9	10
First	1	▨									
	2		▨								
	3			▨							
	4				▨						
	5					▨					
	6						▨				
	7							▨			
	8								▨		
	9									▨	
	10										▨
	Total										

Table Five

Table Five shows the "steady state" cells along the diagonal from upper left to lower right. All sequence pairs in which the two numbers are identical will be tabulated in the steady state cells. Such pairs occur when the speaker remains in a particular category for more than three seconds. All of the other cells are transition cells.

The cell with the highest frequency of the entire matrix is typically the 5-5 cell, which lies on this diagonal, indicating that the teacher frequently takes longer than three seconds when he provides information through lecture. Above average frequencies on this diagonal from categories one through seven indicate that the teacher is being deliberate in his communication.

An above average loading in the 2-2 cell shows that the teacher extends his praise statements beyond a mere, "Very good!", "That's fine!", etc. into longer statements. Longer praise statements frequently include the criteria for praise, that is, they make use of the implied or literal "because" that is so important in the control of dependence.

A teacher who gives praise when the reasons why something is praiseworthy are not clear leaves the student in the position of wanting to please the teacher, but not knowing exactly how to do it. An explanation with praise is likely to include an insight, a value or comment on style that the student will find useful in guiding his behavior in the future. Longer praise statements are more likely to get through to the student and give him greater reward.

These comments about the 2-2 cell are equally true of the 6-6 cell; longer directions often include reasons why or explanations about how to do something so that students can proceed with their work in a more independent fashion.

An above average frequency in the 3-3 cell often means that the teacher develops the ideas of students with considerable care--a mark of a truly indirect pattern of influence.

The 8-8 and 9-9 cells are most important as an indication that students have the opportunity to develop their own ideas. A high loading in the 9-9 cell often indicates student-to-student communication.

An above average frequency in the 10-10 cell can indicate a number of things, depending on other cues. For example, when criticism is present it may indicate lack of cooperation, resistance, or just indifference. In combination with more favorable questions and student talk, it may indicate thoughtful pauses or just a slow tempo of interaction.

Above average frequencies in the 7-7 cell may be due to excessive self reference and anecdotes or it may, with supporting patterns, indicate a burst of anger or criticism on the part of the teacher.

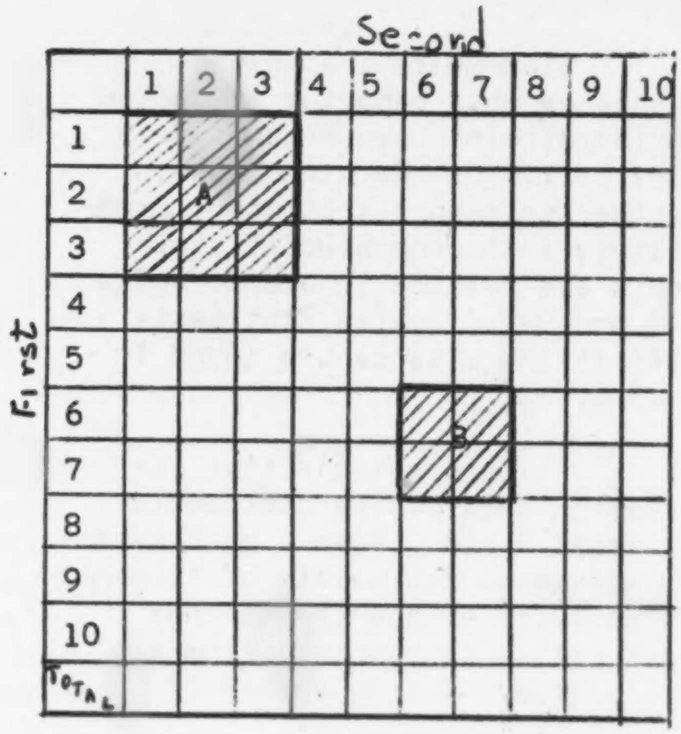

Table Six

Two areas that are most sensitive to the positive and negative aspects of a teacher-student relationship are shown in Table Six. Area A might be called "constructive integration," while B is the "vicious circle."

In area A, the 2-3 cell (read "2-3 cell" as row two--column three) is the shift from praise to the clarification and development of a student's idea, while the 3-2 cell is the reverse transition. Other combinations with clarification of feeling, category one, usually indicate the teacher's concern with positive motivation and reward.

The vicious circle gets its name from the sequence in which the teacher gives some directions, the students resist, the teacher criticizes and then gives more directions, the students resist even more, and so it goes. A heavy loading in area B in combination with student participation in column nine often indicates overt resistance.

Both of these areas indicate the teacher's attention to the process problems of classroom management and control, which can be distinguished from concern with subject matter.

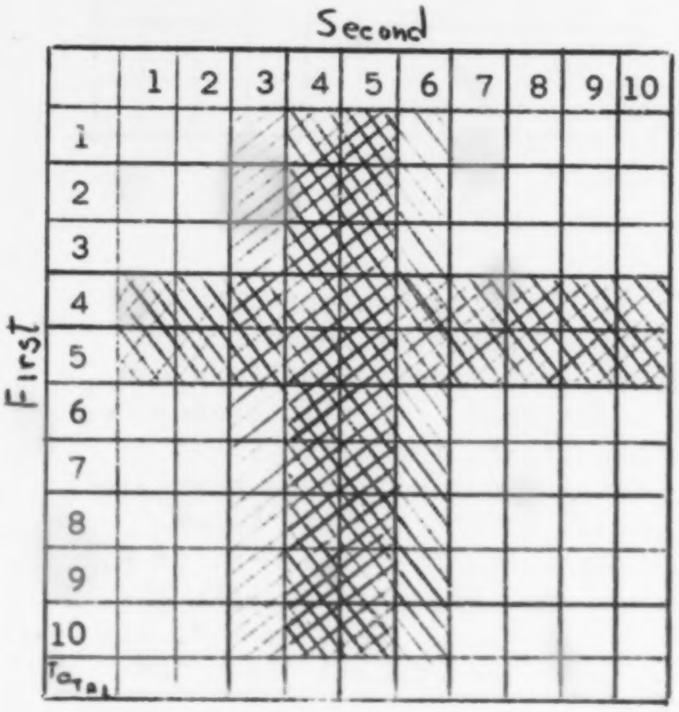

Table Seven

Table Seven illustrates the "content cross" of the matrix which reflects emphasis on subject matter. This cross lies primarily in rows and columns four and five, but overlaps a little in the three and six columns. Most of the tallies in this area are directly related with the content of instruction. The asking of questions and the giving of information can account for 70 to 90 per cent of what the teacher says, but a median range is typically from 75 to 80 per cent. (Note: these percentages refer to teacher statements only, categories one through seven.)

Second

First	1	2	3	4	5	6	7	8	9	10
1										
2										
3			D	E						
4								A		
5										
6										
7										
8			C	B						
9										
10										
Total										

Table Eight

Within the content cross a number of patterns representing typical classroom situations can be identified. To illustrate one such pattern, the cells A and B in Table Eight will have high frequencies during a short answer drill situation. Cell 4-8, or A, occurs when the teacher asks a short question. Cell B, 8-4, occurs when the student gives the answer.

If the teacher should clarify or develop the student's answer, then area C, 8-3, will be indicated. This would then be followed by area D or E, as the teacher moved from clarification to asking another question. Drill situations are easily identified in an interaction matrix.

The use of praise can be studied by noting the distribution of tallies in column two, indicated in Table Nine. All praise statements that are buried in teacher talk will occur in column two, rows 1 to 7, area A. For example, when the teacher says, "We are going on a field trip today. I was very pleased to notice that on our last trip you were all so well behaved. I am sure that you will be just as courteous to the driver today," the middle praise statement refers to past behavior.

Statements that praise future or past behavior are often buried within a sequence of teacher talk. On the other hand, praise statements that occur immediately following student statements are tallied in area B, cells 9-2 and 8-2. Praise statements that follow silence are found in Area C.

It is our subjective impression that praise statements in areas B and C have a much greater effect on the morale of students. An analysis of how the teacher uses praise is possible from a close study of frequencies in column two.

Second

First	1	2	3	4	5	6	[illegible]	8	9	10
1		▨								
2		▨								
3		▨								
4		A								
5		▨								
6		▨								
7		▨								
8		B								
9		▨								
10		C								
Total										

Table Nine

Second

First	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8	▨	▨	▨	▨	▨	▨	▨			
9	▨	▨	▨	▨	▨	▨	▨			
10										
Total										

Table Ten

One of the most sensitive tests of a teacher's attention to the needs of students can be made by studying the shaded area in Table Ten. A teacher who is genuinely concerned with what the student is saying, with HIS ideas and how they can be used, and with encouraging student participation, will produce higher frequencies in the eight and nine rows, columns one through four.

A teacher who ignores student participation and moves on without taking time to recognize and use the ideas offered by students, will have higher frequencies in the same rows, columns five, six and seven. When teachers do not make full use of student verbal contributions, this is easily detected in the matrix.

Second

First	1	2	3	4	5	6	7	8	9	10
1								▨	▨	
2								▨	▨	
3								▨	▨	
4								▨	▨	
5								▨	▨	
6								▨	▨	
7								▨	▨	
8								▨	▨	
9								▨	▨	
10								▨	▨	
Total										

Table Eleven

The shaded area in Table Eleven reveals the particular circumstances in which students begin talking. The highest loading in these columns is normally expected in row four, when the teacher asks a question. Whenever the row four cells do not have the highest frequencies, this fact provides interesting inferences.

The balance of frequencies in columns eight and nine indicates whether students are primarily responding to the teacher or initiating their verbal contributions. By noting what preceded either an eight or a nine tally, it is possible to reconstruct the quality of the stimulii that trigger student verbal participation.

Table Twelve

	1	2	3	4	5	6	7	8	9	10	TOTAL
1	-	-	-	1	-	-	-	-	-	-	1
2	1	-	-	6	5	-	-	-	-	-	12
3	-	-	8	17	4	1	-	-	2	-	32
4	-	-	-	14	3	-	1	38	48	-	104
5	-	1	-	26	62	8	5	-	1	2	105
6	-	-	-	5	5	13	-	1	-	3	27
7	-	1	-	2	4	-	3	1	-	2	13
8	-	5	9	15	6	-	3	4	2	-	44
9	-	4	14	17	13	2	1	-	13	2	66
10	-	1	1	1	3	3	-	-	-	8	17
TOTAL	1	12	32	104	105	27	13	44	66	17	421
% GT	0.2	2.9	7.6	24.8	25.0	6.4	3.1	10.5	15.7	4.0	(100)
% TT	0.3	4.1	10.9	35.4	35.7	9.2	4.4	Teacher T = 294 (69.8%) Student T = 110 (26.2%)			

Applied Interpretation:--Table Twelve is the matrix of a twenty minute teacher-pupil planning session in a seventh grade social studies class. A number of interpretations can be made from such a matrix.

The first inference is that the teacher is very active, most communication is directed toward the teacher, and thus control of the interaction rests with the teacher. The support of the inference comes first from the high 70 per cent participation of the teacher. Also, most student statements follow teacher statements; only 17 per cent of student talk follows student talk.

Second, the quality of the teacher's participation is much more indirect than usually occurs; 50.7 per cent of all teacher statements are indirect, which is well above average for normal classroom interaction. The teacher is even more indirect when responding to student talk; 72 per cent of all teacher statements made right after a student stops talking are indirect (see rows eight and nine--columns one through seven). The effectiveness of the teacher's indirect pattern is reflected in the three-to-two ratio of tallies in columns nine and eight, indicating that an above average number of student statements were initiated by students.

Third, the flow of communication between the teacher and the students and the flexibility with which the teacher shifts from one category to another is higher than average. For example, only 30 per cent of the tallies lie on the steady state diagonal. It appears that both the teacher and the students are attentive in their work, judging from the fact that the students never let silence follow a teacher question and the teacher rather than the students, initiates talk following silence.

Emotional affect is quite low while the emphasis on content and the business at hand is quite high. The absence of 6-7's and 7-6's indicates that no "vicious circle" occurs; the low frequence of tallies in the upper left hand block of categories 1, 2 and 3 shows little attention to (or no need for) accepting or clarifying feelings and making lengthy praise or encouragement statements. Praise, when it is given, occurs directly at the termination of a student statement in 9 out of 12 instances.

The reader may have noticed that most inferences made from this matrix require reference to averages that have not been given. In the appendix of the manual, normative expectations for seventh grade two-hour social studies classes and eighth grade single hour mathematics classes are shown. Ignoring, for the present, a cell by cell comparison of the matrix just interpreted with average expectancies, our experience suggests the following questions and observations in reference to this short planning session.

Why is the teacher participation so high? There is ample evidence that this teacher has an above average talent for flexible teacher influence. Such a teacher typically participates less, say 50 or 60 per cent, in a planning session of this type. A conference with this teacher would probably provide an answer to the question. It may be, for example, that the students are inexperienced at teacher-pupil planning and are not yet ready to take advantage of the opportunity this teacher skillfully provided.

It is also possible that the teacher was sensitive to some sort of time pressure such as occurs near the end of a class period or could be due to the limit of two weeks imposed on the unit of study. In this case, the time limit was due to the requirements of an experimental design. The matrix merely raises this question; additional evidence is necessary for an adequate answer.

The matrix does show an above average indirect approach to the clarification of classroom goals. In the process, students are encouraged to express their opinions and preferences. Ideas suggested by students are usually accepted, clarified and used.

The class is very businesslike and works rapidly. There is no evidence of disciplinary problems. The process is dominated by the teacher and the class is probably quite dependent on teacher direction and support.

All of these inferences were made by the author from the matrix in Table Twelve without the benefit of having visited the class. The conclusions reached were checked with the observer who made the original observation and found to be substantially correct.

The only additional comment made by the observer was that most of the student talk in response to the teacher, category eight, occurred during the first ten minutes; most of the student-initiated student talk, category nine, occurred during the last ten minutes.

If true, this subjective impression of the observer is a partial answer to the question about high teacher participation. Had the session lasted longer, the trend of the last ten minutes would have developed more extensively and a higher per cent of student participation would have materialized.

These modifications of the interpretation made by a person who was not in the classroom have two implications. First, the matrix provides so much information that even a person not present during the interaction can make many accurate inferences about the communication and can reconstruct a fairly complete picture of what took place. Second, the most effective interpretations of a matrix can be made by the observer who recorded the original data.

The Statistical Problems of Comparing Matrices

At the beginning of the last section, reference was made to annoying statistical problems in the analysis of interaction data. Bales (6) was the first to show that classified events of communication are inter-dependent. Each event affects the probabilities that a particular event will follow. The basic interdependence of interaction data is present whenever communication events are recorded by an observer in the classroom. As a result, it is inappropriate to test whether two distributions within the ten categories are significantly different by the use of Chi-square.

The first qualified statistician to become interested in this problem, as it applied to classroom interaction analysis, was Dr. John H. Darwin, Department of Scientific and Industrial Research, Wellington, New Zealand. It was at his suggestion that our classroom interaction data were collected by a procedure that preserved the original sequence so that sequence pairs could be tabulated in a matrix.

Darwin (7) developed a likelihood ratio criterion to test that hypothesis that the frequency of distributions in two or more matrices are the same. This procedure will be described in the second division of this section; first, we turn to a short discussion of how a regular Chi-square test is distorted by interdependence between tallied events.

Insensitivity of Chi-square to Sequence:--In any enumeration of events in two or more categories, the Chi-square test is insensitive to sequence. As part of his general analysis of this problem, Darwin (7, p. 415) outlines a test for comparing two or more arrays distributed in "n" categories. He illustrates the bias that occurs when such a comparison is made by applying both his test and an ordinary Chi-square test to a simple 2 X 2 contingency table. Given two possible events, the probabilities of a 1-1, 1-2, 2-1, and 2-2 sequence pair occuring are illustrated to the right. Darwin shows that the difference between the criterion he develops by taking into account dependence within sequence pairs and a regular Chi-square test is shown by the multiplier,

$p_{1,1}$	$p_{1,2}$
$p_{2,1}$	$p_{2,2}$

$$\frac{p_{1,2} + p_{2,1}}{p_{1,1} + p_{2,2}} .$$

This ratio approaches one as the four probabilities approach equality. In our data the probability of the same event following itself is always greater than the probability of a transition to another category. The denominator of the above ratio, particularly when extended to ten categories, is nearly always greater than the numerator. When the Chi-square criterion is reduced by this factor, there is less chance that the null hypothesis will be rejected, when in fact, it is true. The magnitude of this correction will vary according to the frequency distribution. An example cited by Darwin shows that the regular Chi-square was twice as large. In some matrices we have tabulated, the reduction may be as great as one-fifth.

All of Darwin's analysis is

based on the assumption that interaction sequences are one-dependent or Markoff chains which is a much better approximation than the zero-dependent assumption of Chi-square. Communication events are, in fact, more than one-dependent, but the additional dependence of three or more events is small by comparison to the dependence between two events.

Comparing Interaction Matrices:--Given two or more matrices, the null hypothesis concerning the matrix distributions can be tested by a likelihood ratio criterion suggested by Darwin (7, p. 413).

$$2\,[\underbrace{\Sigma n_{jkl} \log_e n_{jkl}}_{(K)} - \underbrace{\Sigma n_{j.l} \log_e n_{j.l}}_{(L)}$$

$$- \underbrace{\Sigma n_{jk.} \log_e n_{jk.}}_{(M)} + \underbrace{\Sigma n_{j..} \log_e n_{j..}}_{(N)}]$$

A dot in place of a suffix means that summation has been carried out over the replaced variable.

The procedure for applying this test to two matrices is outlined in the steps below.

Step One: Prepare a 10 X 10 matrix "A" and the second matrix "B". Check to see that the sum of the corresponding rows and columns within each matrix are equal. An unbalanced matrix may be due to an error in tabulation or due to the fact that the first and last events in the sequence were not identical.

Step Two: Prepare a third matrix "C" which is a combination of A + B. The addition is performed cell by cell, that is,

$$A_{1-1} + B_{1-1},\ A_{1-2} + B_{1-2},\ \ldots$$

$$A_{5-5} + B_{5-5},\ \ldots\ A_{10-10} + B_{10-10}.$$

Matrix C should also balance and the sums of the corresponding rows and columns should equal the combined sums of the rows and columns in matrix A and B. The check is C = A + B for all cells and totals of rows and columns.

Step Three: The first term "K" is found by multiplying each cell frequency by its own natural logarithm ($n \log_e n$), adding these 100 products from A to the 100 products from B, and the sum will then equal the first term K.

Step Four: The second term "L" is found by multiplying each row total by its own natural logarithm, adding the ten products from A to the ten products from B, and the sum will then equal term L.

Step Five: The third term "M" is found by multiplying each cell frequency in the C matrix by its own natural logarithm, adding the 100 products, and the total will then equal term M.

Step Six: The fourth term "N" is found by multiplying each row total of matrix C by its own natural logarithm, adding the ten products, and the total will then equal term N.

Step Seven: The terms are combined as indicated, that is, 2 [K - L - M + N]. If logarithms to the base ten are used, the formula becomes 4.605 [K - L - M + N].

Step Eight: For two 10 X 10 matrices, this criterion has a sampling distribution of Chi-square at 90 degrees of freedom. Since Chi-square approaches a normal distribution for higher degrees of freedom, the above criterion can be converted to a standard score "z" as follows: $z = \sqrt{2x^2} - \sqrt{2n - 1}$, where $n = s(s-1)$ and s is the number of categories. For two 10 X 10 matrices, this formula becomes,

$$z = [2x^2]^{\frac{1}{2}} - 13.379.$$

When z is 2.58 or larger, the null hypothesis is rejected at the 0.01 level of confidence.

The application of this test to more than two matrices is straightforward. Term K will include the cell by cell addition of all matrices. Term L includes the row by row addition of all matrices. Term M is calculated from a single, combined matrix in which the cell totals are determined by the addition of frequencies in the corresponding cells of the individual matrices. Term N follows the same procedure with the row totals of the combined matrix. The degrees of freedom are s(s-1)(r-1); s is the number of categories and r is the number of matrices.

The above procedure has been programmed on the electronic computer at the University of Minnesota, a Univac Scientific 1103, and takes approximately 23 seconds to calculate. The data feeding period is determined by the I.B.M. card reading rate; one card per matrix row is required.

Darwin also shows that the basic equation, which he has numbered 3 in his article and which is shown on page 26 of this manual, is a combination of two other criterion tests. One of these is a criterion test of the transition pairs and the other is a similar test with steady state pairs. (See Darwin's equations 3 and 4 respectively.) The assumption necessary to these last two criterion tests is that the time interval required for a single observation is shorter than the duration of all or nearly all communication events. This assumption can easily be realized by increasing the tempo of observation. At the present tempo, rapid exchanges of the question-answer type (4-8) can cause category shifts within the time unit allotted to a single observation. An experienced observer could increase his tempo and have no difficulty in recording practically all transitions. These two additional tests provide more information than the single criterion and all three can be used to supplement each other.

The final test Darwin develops can be applied to row totals or the total number of events within a particular category. The calculations of this test require the multiplication and inversion of matrices, a procedure best carried out on an electronic computer.

The contribution of Dr. Darwin to our statistical problems is gratefully acknowledged. At the time this manuscript is written we have not applied all of his tests and more exploration of their power and usefulness is yet to be carried out. We are particularly concerned with the criterion test already presented as a procedure for identifying matrices that are sufficiently homogeneous to be combined.

It is interesting to speculate on applications of Darwin's work to fields other than interaction analysis. In any situation in which the sequence of enumerated events should be considered and the assumption of one-dependence is appropriate, the procedures outlined can be used. We believe, for example, that our computer program can be used for a matrix of any shape within the limits of a 10 X 10 by simply entering zeros in the unused cells and adjusting the degrees of freedom. The application of the test to smaller matrices (and even a 10 X 10) can be carried out with a desk calculator. We have found that a clerk can complete the comparison of two 10 X 10 matrices, providing he has a table of logarithms at hand, in about 8 hours using an automatic desk calculator.

Applications of Interaction Analysis to Education

This manual is being written before most applications of interaction analysis to the problems of education have been explored. The Minnesota system concentrates on teacher influence and is a research tool for assessing the teacher's control of classroom interaction.

Broadly speaking, interaction analysis is a procedure for quantifying selected qualitative aspects of spontaneous behavior. The nature of the categories used and the procedures of observation determine which qualities of behavior are studied and thereby set the limitations of the research tool.

There are many urgent problems in education to which the categories described in the manual do not apply. For example, different categories would be necessary to study how students influence each other in classroom interaction, how a counselor influences the client in an interview, how an administrator uses his power in his contacts with teachers, and other similar topics.

However, many of the procedures of training observers, estimating reliability, tabulating data in matrices, and analyzing data could be adapted to other category systems based on different theoretical concepts and designed to analyze behavior in different educational situations. The applications about to be discussed are limited by the present system, but interaction analysis as a technique could apply to a wide variety of problems.

The first part of this last section will discuss research designs and theoretical hypotheses to which the application of our present categories seem practical.

The second and concluding section will discuss how the present system can be used in in-service training programs to feed back information to teachers who desire to improve their teacher-pupil contacts.

Applying the Minnesota Categories to a Theory of Instruction:--A theory of instruction can be distinguished from a theory of learning because the former incorporates concepts and principles about the teacher's behavior while the latter places greater emphasis on the student's behavior. One might even argue that the application of theories of learning to practical classroom activities is to create a theory of instruction. The development of a theory of instruction will require, sooner or later, some empirical verification of theoretical hypotheses. Many of these hypotheses will be concerned with patterns of teacher influence. The standardization of the Minnesota system is a first step in the "tooling up" phase of this kind of research.

The first application of this research tool in our program of research was to see if relationships could be found between patterns of teacher influence and scores on various kinds of student attitude inventories.

One inventory developed for this purpose included five basic scales that were thought to describe classroom climate: (a) teacher attractiveness, (b) motivation for work, (c) fairness of rewards and punishments, (d) disabling anxiety, and (e) independence of teacher supervision. In urban schools of both Minnesota and New Zealand, it was found that an above average pattern of indirect influence based on six to ten hours of observation per teacher is associated with above average scores on the attitude inventory in which the items are keyed to the more desirable response.

Only in New Zealand was the complementary relationship found that an above average pattern of direct influence is associated with below average scores on the attitude inventory.

During the period from July, 1958 to September 1960, our research program at Minnesota has made use of interaction analysis to study relationships of teacher influence to achievement in seventh and eighth grade classes of mathematics and social studies.

This project has been carried out with the support of the Cooperative Research Program of the U.S. Office of Education. A terminal project report will be available after September 30, 1960.

The application in this instance is to see if teachers tend to use different patterns of influence when introducing learning goals to the class, supervising their work, evaluating their work, and in other similar activity periods. The results of this project will show that students are not equally sensitive to differences in the teachers' patterns of influence. When the achievement scores of students who are more sensitive to teacher influence are considered, significant differences in achievement can be associated with different patterns of teacher influence.

In a more speculative vein, a number of different projects involving the application of classroom interaction analysis can be imagined. One interesting question is whether different types of students are exposed to different patterns of teacher influence.

For example, are the teacher-pupil contacts of a creative student, an under-achiever, etc. typically different from other students and from one teacher to the next?

Another application would be to see if teachers who are grouped according to personality trait information provide similar patterns of influence in the classroom.

Another application would be to investigate the concept of "flexibility of teacher influence" and to study how teachers adjust their patterns of influence to meet different classroom situations.

The investigation of any of these problems would contribute to our understanding of the process of instruction and classroom control.

Perhaps the most important application of the Minnesota categories would be to use classroom interaction analysis as a control measure in an experiment involving the evaluation of teaching methods. In the past when one class is taught by method A and another by method B, there has been no systematic and direct measure to show whether the behavior of the A teachers is similar, the behavior of the B teachers is similar, and the qualitative differences between the behavior of the A and B teachers. The presence or absence of differences and similarities among the experimental teachers is usually controlled by randomization or it is inferred from dependent variables. Interaction analysis provides a powerful control in an experimental design to explain within group and between group variance associated with the teacher's influence.

Data from interaction matrices

can be grouped in different ways depending on the experimental design. In studies of teacher influence one may wish to test the hypothesis that teachers behave differently during certain phases of classroom problem solving. If these phases can be reliably identified, segments of interaction for the same teacher or a group of teachers can be combined for each phase and the between-phase differences analyzed.

In more broadly based studies, combined matrices can be used to compare classroom interaction at different age levels, sex of teacher contrasted with sex of student, different subject matter areas, and other dimensions that obviously affect teacher-pupil contacts.

Tests of homogeneity of matrices, prior to combining, can be adapted from Darwin's work described in the previous section.

One product of our present research is the development of a scale to measure the student personality trait of dependence proneness. We have found that students who score high on this scale are more sensitive to different patterns of teacher influence. The attitudes and work of students who score low are less affected by different patterns of teacher influence. Each type of student has a somewhat different picture of an ideal teacher.

As research provides more and more information about matching student expectations with the teacher's normal pattern of influence, some of our present systems of grouping students for the purpose of class assignment in departmentalized schools may be altered. Interaction analysis can be used to provide the data necessary to classify types of teaching styles in this area of research. It can also be used to study the growth of student dependence on the teacher in classroom activities.

On those occasions at which the author has been asked to talk to teachers about past research and future opportunities involving interaction analysis, a question usually is asked about whether this kind of research will eventually lead to the evaluation of teacher effectiveness. As soon as this topic is raised, the implications for administrative policies about promotion, merit pay, and master teacher classifications are obvious.

Predicting "what research will lead to" is pure speculation and the only reasonable answer that can be made is that interaction analysis is not yet well enough standardized to be applied to this controversial problem. As a result of discussing teacher evaluation with teachers, it seems equally apparent that the teachers are also not ready.

We have studiously avoided any reference to teacher evaluation in soliciting the cooperation of teachers in our research. We have achieved teacher cooperation by emphasizing that our major concern is the analysis of teacher-pupil contacts and that there are so many different kinds of learning activities, so many styles of teaching, and so many types of pupils, that a great deal of research will be necessary before teaching effectiveness can be evaluated.

On the other hand, every valid conclusion about classroom learning brings the teaching profession one step closer to establishing the criteria for effective teaching.

Meantime, the fear of most teachers and the reluctance of most administrators to discuss the evaluation of teaching effectiveness does not appear to be changing. As small bits of progress are made in educational research and as members of boards of education and educational critics show increasing interest in the topic, it is clear that an impasse is developing.

The impasse can be avoided only by having the tools ready at the same time that educators are willing to use them. The only type of evaluation that will work is one that is proposed by teachers and administered with their support and cooperation. In any case, research on classroom learning and the part that the teacher plays in this process must go on in order to improve the quality of education.

Applications of Interaction Analysis to Inservice Training:--One difficult barrier to successful inservice training can be stated by paraphrasing Kurt Lewin, "Knowledge of principles of instruction in no way insures their application." The major problem is not lack of knowledge about how to teach--most teachers are already well informed. Even increasing a teacher's knowledge about what to teach has the limitation that new content must be incorporated in classroom learning activities. In both cases it is the relationship between the teacher's control of his own behavior and his intentions that must be improved.

The observation procedures described in this manual can be used to feed back information to teachers about their overt acts of influence. A teacher might agree to have an observer present when he tries some new approach to instruction. Twenty-four hours later the observer and the teacher can have a conference to discuss the resulting interaction matrix, inferences from this matrix, and supplement the discussion with a tape recording of the session. Their conclusions can then be compared with the teacher's intentions. In this fashion a teacher can obtain information about his overt behavior, the reactions of students, and obtain feedback heretofore unavailable.

The possibilities of this procedure prompted our research staff to submit a second research proposal to the Office of Education under the provisions of the National Defense Education Act, Title VII, covering the period from July, 1959 to September, 1961. During 1960-61 we will make use of written materials and sound filmstrips on the topic of teacher influence to conduct an in-service training program designed to improve patterns of teacher influence.

In the fall, participating teachers will be observed in order to have a pre-training set of matrices. In the winter, teachers will work with observers to understand and, hopefully, improve their patterns of influence. In the spring, post-training observation data will be compared with fall data to provide a measure of any changes that have occurred.

The use of interaction analysis in the in-service setting obviously involves an especially fine relationship between the teacher and the observer-consultant. A relationship must be created in which the feedback information becomes available in a form that the teacher can accept and use.

In the few attempts we have made to date, the teachers whose own intentions are most inconsistent with matrix conclusions and are in a position to gain the most information are the most defensive about their performance. Maintaining good rapport and patience will be necessary to achieve a good working relationship. It is quite likely that not all teachers can benefit from this kind of training, but most teachers can.

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APPENDIX

The next two pages contain two master matrices from a recent research project. The first represents 51,835 tallies collected in seventh grade two hour combined English/social studies classes in the public schools of Minneapolis and St. Paul. The second matrix of 58,614 tallies comes from eighth grade mathematics classes in the same urban area.

The teachers were selected for observation by the following procedure. All seventh grade English/social studies and eighth grade mathematics classes in the Twin Cities were given a test measuring attitudes toward the teacher and the class. The eight classes with the highest class averages and the eight with the lowest were combined to form a sample of sixteen classes. All classes were observed for a minimum of four hours, most at least six hours. Each combined matrix represents over 90 hours of observation. Note that about 40 to 50 per cent of the time no interaction data were collected because students were busy at seat work or other projects.

Table Thirteen

Seventh Grade Social Studies

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1				12	10	4	3	2	7	2	40
2	3	45	96	150	144	46	11	25	52	54	626
3	2	55	812	661	735	75	29	145	291	247	3,052
4	7	15	35	1109	244	127	61	3103	524	360	5,585
5	12	55	57	1491	12,786	574	188	164	632	667	16,226
6	5	10	7	230	366	1341	140	385	237	823	3,544
7	2	11	5	188	205	137	760	58	94	273	1,733
8	0	271	1028	962	908	280	140	5941	241	249	10,020
9	2	134	975	301	607	251	111	18	2084	246	4,729
10	7	30	37	481	621	709	290	179	567	2959	5,880

The figures in this table represent the interaction analysis of more than 80 hours of classroom instruction in 16 seventh grade social studies classes in a large urban area. The total number of tallies in this matrix is 51,835.

Table Fourteen

Eighth Grade Mathematics

CATE-GORY	1	2	3	4	5	6	7	8	9	10	TOTAL
1	7	2	4	12	42	4	3	2	7	12	95
2	3	71	94	124	220	50	8	11	63	134	778
3	7	83	939	562	795	60	20	98	217	173	2,954
4	9	23	23	941	285	129	35	4129	309	470	6,353
5	36	73	79	2336	20,116	815	274	114	831	718	25,392
6	1	5	6	200	451	1172	118	736	256	790	3,735
7	1	8	6	138	285	145	680	52	121	326	1,762
8	9	323	1098	1282	1579	477	167	1705	191	200	7,031
9	13	135	679	283	911	286	152	16	1144	214	3,833
10	9	55	26	475	708	597	305	168	694	3644	6,681

The figures in this table represent the interaction analysis of more than 80 hours of classroom instruction in 16 eighth grade mathematics classes in a large urban area. The total number of tallies in this matrix is 58,614.